CURRENT SCIENCE

Vol. XI] SEPTEMBER 1942 [No. 9

MALARIA AND ANTIMALARIALS

AMONG the several diseases which afflict this country, malaria occupies the foremost place; it is the largest single disease endemic in India. Annually a third of the population of this sub-continent is said to suffer from malaria, and the percentage of deaths among them is appallingly high. Those who survive the attack suffer from its after-effects which often leave a permanent injury on the patient. The loss of economic man-power and human efficiency due to this disease in the British Empire has been estimated at 52 to 62 million pounds a year, more than half of which is shared by this country.

For decades this widespread disease has been allowed to go practically unchecked and no determined and sustained effort commensurate with the magnitude and seriousness of the problem, has been put forward. In this connection, special mention should be made of the Rockefeller Foundation for the valuable services rendered to the Provincial Governments in conducting malarial surveys in the several provinces, and for furnishing the necessary technical personnel.

Methods for combating this disease are well known and they have been widely and successfully adopted in other countries like Italy and Greece. They consist of the destruction of larvæ, the draining of swamps, mechanical protection against mosquitoes and prophylaxis by quinine or atebrin and plasmoquine. The problem in this country is complicated by the undernourished and poverty-stricken condition of its people. The *per capita* consumption of quinine in India as compared with other malaria-stricken countries is only three and a half grains

as against the 16 and 24 grains respectively in Italy and Greece. The question of malaria control is, therefore, closely connected firstly, with an adequate supply of prophylactic drugs at prices which the average Indian can afford to pay, secondly with the speed and efficiency with which the sources of vectors could be minimised if not abolished and thirdly, with the raising of the standard of nourishment among the masses.

Col. Chopra, in an admirable review of the position of quinine in this country, computes that the maximum potential demand for this drug is 1,500,000 lb. The Public Health Commissioner to the Government of India is of the opinion that "there is no question of the effective treatment of malaria in India until the consumption of quinine approximates to 500,000 lb." Sir Patrick Hehir has estimated that for India, 970,000 lb. of quinine would be the minimum necessary for a successful tackling of the problem of malaria. At the moment, India's annual production of quinine lies between 60 to 70 thousand pounds, which is supplemented by another 130,000 lb. of imported material. These figures reveal the utter helplessness of the situation and call for the most vigorous effort on the part of those interested in the control of this preventable disease.

The Royal Commission on Agriculture realised the acuteness of this problem and made far-reaching recommendations calculated to make India self-sufficient with regard to this drug. They have pleaded for a rapid expansion of the acreage under cinchona; the evidence presented before the Commission had revealed that for many years the progress of cinchona cultivation in the country, had remained practically stagnant, in spite of the circumstance that large tracts of territory authoritatively pronounced to be suitable for its propagation, were found to be available. In view of the imperative urgency and vital importance of this matter, the Royal Commission urged that the Central Government should take up the responsibility of producing and distributing this drug.

In 1928, a committee of representatives of the various Provincial Governments interested in the propagation of cinchona, was called with a view to elicit their advice regarding the extent and manner in which the recommendations of the Royal Commission could be given effect to. The Committee was immediately faced with the financial aspects of the problem and recommended a scheme through which all profit which might accrue would be shared equally by all the consumers. The Malaria Commission of the League of Nations emphasised the importance of quinine as the prophylactic *par excellence* in the remission of malaria. In spite of all this forceful expression of authoritative opinion and in the face of the brilliant examples of public health administration in other parts of the world, nothing substantial or effective has been achieved in controlling the disease in India. Considerations of philanthropy, humanity and charity and of public health obligatory on all Governments, have been overpowered by the modern "shopkeeper instinct". We must here refer to the unostentatious and silent part played by indigenous systems of medicine which have been bringing relief to the millions of the malaria-stricken in

rural districts. Captain G. Srinivasamurthy (formerly Principal of the School of Indian Medicine, Madras), who is one of the foremost exponents of Ayurveda, has revealed to us that during the days of the East India Company, a number of indigenous antimalarials were "authorised as official substitutes for cinchona and its alkaloids. They were also included in the pharmacopœia of India which was then in use as supplement to the British pharmacopœia". It is regrettable that these specifics have not continued to receive the official recognition with the rise of quinine as the official drug for malaria.

Cinchona was introduced in India and Java at about the same time; its propagation made considerable headway in this country and at one time it looked as though the country would not only satisfy its requirements but produce a surplus with which a prosperous but not a profiteering export trade could be built up. But Java which was backed up by intensive methods of scientific selection and propagation, evolved varieties which yielded richer percentages of the alkaloid. The Dutch are the foremost in the field of plant improvement and have successfully demonstrated their scientific talent and skill with regard to a number of other economic crops like the sugarcane and the tobacco. The valuable experience in these lines, was utilised for the improvement of cinchona which has been responsible for the supremacy of Java in the production of quinine. Overproduction of this drug threatened to reduce the prices to an uneconomic level but the "Kina Bureau", a powerful syndicate, stepped in to control the world price of quinine. Col. Chopra writes in this connection:

> "The Kina Bureau has tried and has been successful in effecting regulated and gradual reduction of the cinchona areas to proportions fitted to what the world can afford to buy and not what it really needs. In this way the price has been maintained at a level that leaves a profit both for the plantations and the factories."
>
> "It follows from all this that it would be absolutely futile to expect any large reduction in the price of quinine under the present conditions. So efficient is the control that even the great world-wide depression during recent years has not affected the price of quinine, which still remains at Rs. 18 per pound, which was the price fixed so long ago as 1926."

This monopoly has been challenged by Germany. As a part of their programme of colonial expansion, Germany was keenly interested in the synthesis of specifics for all the tropical diseases like sleeping sickness, yellow fever, malaria, etc. Intensive work on synthetic antimalarials was launched and in the year 1926, the Elberfeld Chemical Research Laboratory of the I.G. Farbenindustrie, announced the synthesis of plasmoquine. Four years later Atebrin was synthesised. These two synthetic drugs have now been in use in this country as antimalarial specifics. Medical opinion in India, while recognising the efficacy of the two drugs, is averse to their general adoption. These drugs have to be administered under careful medical supervision; otherwise they may prove highly toxic. So far as mass treatment of malaria is concerned, quinine still holds the field, since the drug can be safely administered and is even recommended for self-medication. But the price of quinine is too high. "We cannot get away from the fact that quinine is the rich man's remedy, while malaria is the poor man's heritage; but let medicine once admit and practise the

value of the other alkaloids and many Indian areas might then be turning out febrifuge at costs more suited to the poor. For, with a change of medical opinion and practice we could make use of kinds of cinchona that do not demand java soil and climatic conditions for their best development." This extremely helpful suggestion made by the Government Cinchona Department and Factory in Bengal, is supported by Col. Chopra who adds, "It is unfortunate for India that of all the alkaloids of cinchona bark, the merits of quinine alone should have been recognised by the medical profession, with the result that a monopoly has been created for the plantations and factories of Java. A reference to the history of the treatment of malaria in a recently published work by Lieut.-Col. R. Knowles and Senior-White, shows that this routine use of quinine sulphate is more or less an accident and that 'it is very far from certain that quinine is the best alkaloid of cinchona bark to use. Both quinidine and cinchonidine are more efficacious with regard to their anti-malarial power'. The important investigation carried out by Fletcher in Kuala Lampur in the Malay States and the experience at the Calcutta School of Tropical Medicine show that alkaloids of cinchona bark other than quinine are quite effective in the treatment of malaria if given in the usual doses in which quinine is given. The total alkaloids of the bark in the form of cinchona febrifuge have been used in the Carmichael Hospital for Tropical Diseases and at the out-patient department of the School for many years with very satisfactory results". In view of this clinical evidence, it is difficult to resist the demand for using the total alkaloids in place of quinine. This will cheapen the cost of production, facilitate the utilisation of the quinine-poor barks now considered uneconomical for the extraction of quinine and conserve the antimalarial resources of the country.

The loss of Java has increased the acuteness of the problem a thousandfold. The price of quinine, which was fixed at Rs. 18 by the Kina Bureau has inflated to Rs. 130 per lb. The synthetic antimalarials have practically vanished from the Indian market. It is high time that the Government realises the importance of taking immediate steps to make the country self-sufficient with regard to this most important drug. In addition to this, it is necessary that the antimalarial specifics of established reputation in the indigenous systems of medicine, should be investigated with the co-operation of the Pandits and the Hakims. Investigations on the breeding of hardier and richer strains of cinchona should be undertaken and these researches may be appropriately financed by the Imperial Council of Agricultural Research, while researches on synthetic antimalarials are to a certain extent being financed already by the Board of Scientific and Industrial Research. A Central Advisory Board to co-ordinate and direct these activities should be constituted. This is a matter which demands the earnest attention of the Central Government.

THE SOURCES OF THE RIVERS INDUS, SUTLEJ, GANGES AND BRAHMAPUTRA

BY

D. N. WADIA

(*Mineralogist, Government of Ceylon, Colombo*)

SINCERE thanks and congratulations of all geographers and of Indian naturalists in particular are due to the Rev. Swami Pranavananda for publishing results of valuable explorations conducted by him during his four pilgrimages in the regions of Mt. Kailas and Manasarowar in Western Tibet. This trans-Himalayan district, lying just north of the Central axis of the Himalayas, held in great veneration by the people of India for 4,000 years, possesses the highest interest geographically, for it is the tract of mountains from which the four greatest rivers of India take their rise. This ground is sanctified by traditions going back to 2000 B.C., being mentioned with reverence in the Vedic hymns of the early Aryan settlers of India. There is reason to believe that this was the part of the Himalayas that the early Aryans were most acquainted with in the centuries following their migration to the plains of India. The beautiful, and in many cases highly expressive poetic names they have given to the peaks, passes, rivers and glaciers of this part of the Himalayas are reminders alike of the courage and enterprise of the Aryan pilgrims as of their love and admiration for the mountains and of their familiarity with them. Few other races of the world have at such early age in history adored mountains and snows, or enshrined them in poetry or mythology; for in most parts of the world mountains were regarded with horror and dread, to be shunned by all decent people for the ordinary pursuits of life.

Judging by the dimensions of the mountain-areas they drain, the four rivers, Indus, Sutlej, Karnali (the longest of the head-tributaries of the Ganges), and the Brahmaputra are the most important Himalayan rivers that drain the everlasting snows on the Indo-Tibetan water-shed and discharge their fertilising waters on the dry plains of India. The sources of these noble rivers, in the sense of modern geographical knowledge have, for over a century, been the subject of controversy among explorers, naturalists and the official surveyors of the Government of India. Although traditions and immemorial beliefs of the early Aryans, which must have had their origin in the explorations of the more intrepid mountaineers among the annual pilgrims, had already accumulated some remarkably accurate facts about the origins of these rivers, this knowledge was so enveloped in mythological and legendary fancies that for geographical purposes it was as good as a sealed book. In 1790 Major Rennell, the Surveyor-General of Bengal, published a map in which the 800-mile course of the Ganges above Hardwar was shown to pass through Kashmir and Ladakh! Since then a number of official surveyors as well as explorers, both of the Survey of India and of foreign countries,—Captains Raper, Webb and Herbert; the Chinese explorers Klaporth, Rhurs, and D'Anville; W. Lloyd and Alexander Gerrard, Henry Strachey, Sandberg, Pt. Nain Singh and Col. Ryder from India have each made contributions in discovering the heads of tributary-streams, springs or glaciers which may be claimed as the sources of these rivers. Sven Hedin, the reputed Swiss geographer, came late in a long line of distinguished Himalayan explorers and made extensive journeys in Tibet and Trans-Himalaya in 1907-10. Sven Hedin's great work, *Southern Tibet*, published in nine volumes in 1917 is, as mentioned by Burrard, a complete library of Tibetan geography and particularly of the region across the axis of the Kumaon-Nepal Himalaya, wherein he has unravelled a series of important facts of orography and hydrography. Among the many genuine discoveries revealing trend-lines of mountain systems and the inland drainage system of Tibet, Sven Hedin has also claimed to be the first to have found the sources of the Indus, Brahmaputra and Sutlej, for thus he speaks in one characteristic passage:

> "... I revelled in the consciousness that, except the Tibetans themselves, no other human beings but myself had penetrated to this spot. ... Providence had secured

> for me the triumph of reaching the actual sources of the Brahmaputra and Indus, and ascertaining the origin of these two historical rivers. ... Not without pride but still with a feeling of humble thankfulness, I stood there, conscious that I was the first white man who had ever penetrated to the sources of the Indus and Brahmaputra. ... No white man had ever seen its source (*i.e.*, of the Sutlej) before now."

Later facts brought to light by Swami Pranavananda from his four long and arduous journeys during the years 1928-38 in the Manasarowar-Kailas region, involving a whole year's stay at one time in this inhospitable country, have raised some doubts regarding Sven Hedin's conclusions. Though not a professional geographer, the Swami has made a record of most interesting, accurate and painstaking observations of natural features and phenomena which provide valid data on the intricate question of fixing the sources of these rivers. The Swami's observations show some discrepancies and inconsistencies in Sven Hedin's discussion regarding the sources of the Indus and Brahmaputra. The sources of many great rivers are usually matters of dispute and long controversy, since the exact point of origin of what is to be regarded as the principal tributary may vary materially with the point of view adopted by the different observers, particularly if the river in question has, as is often the case, a multiple number of head-streams. Is it the head tributary with the largest volume of water, or is it the tributary with the greatest length of course from the water-shed, or the melting end of the glacier, that is to be regarded as the source-stream? Or is local tradition or immemorial belief of the people of the surrounding country to determine the source? It is only in rare cases that all the three factors combine to give the same result; usually it is one of the three that is of preponderating importance in deciding the issue. Sir Sidney Burrard, late Surveyor-General of India, has well cited an interesting example of this. "Some writers define the source of the river as the point of its course that is most remote from its mouth. Colonel George Strahan has shown that if this definition be applied to the Ganges, its source will not be Himalayan at all, but will be near Mhow in Central India at the head of the Chambal!" Local tradition has proved in several cases a correct guide in deciding such questions, especially in the case of river sources held in sanctity for millennia and visited annually by thousands of pilgrims, who in their peregrenations (*pradakshinas*) visit every ramification of the head-stream to the glacier-feeders.

Swami Pranavananda's book *Exploration in Tibet* (University of Calcutta, 1939), deals with the Kailas-Manasarowar part of Tibet, a region of sublime beauty and grandeur, encompassing some 3,500 sq. miles of country, a medley of high mountains above 20,000 ft., lakes and glaciers, which is the nourishing ground of the four greatest rivers of India. From his camping quarters in a monastery on the south shore of the twin-lakes Manasarowar and Rakas Tal, the Swami had unique opportunities of surveying the country around and investigating the merits of the various rival theories as to the sources of these four rivers, which all lie within a radius of 30-60 miles from his camp at the monastery of Thugulo. In his book Swami Pranavananda discusses all the relevant facts about the sources of the rivers Indus, Sutlej, Karnali and Brahmaputra as fixed by the previous observers and by Sven Hedin and presents a fair picture of the state of the controversy before he commenced his own investigation during his numerous *pradakshinas* round the foot of Mt. Kailas and the shores of the holy lakes. Although the last word cannot yet be pronounced on this subject without examining the bearings of the various physiographic factors involved and measurements of the various courses and the quantity of water carried by them, the conclusions to which the Swami has arrived are likely to meet with the approval of most geographers. After actual verification by personal observations of the actual sites he accepts the judgment of hoary tradition and sums up his conclusions as:

> "..., the source of the Sutlej lies in the Kanglung glaciers, east of Manasarowar, 65 miles from Barkha.* The

* Barkha or Parkha is a post stage and official Tibetan transport agency station situated one mile north of the north end of Rakas Tal (*Rakshas Tal*).

source of the Indus is in the springs of Senge Khambab (half a mile north of Bokhar Chu), north of Kailas, 53 miles from Barkha. The source of the Brahmaputra is in the Chemayun-dung glaciers, two days' march east of the Kanglung glaciers or 92 miles from Barkha, and the source of the Karnali is at the Mapcha Chungo spring, about 23 miles north-west of Taklakot."

This conclusion will be generally acceptable to future investigators, for it leaves the question open for the adoption of other criteria for fixing river sources after the necessary exact and quantitative estimations have been carried out. Other glaciers, springs and divides may then be regarded as the sources of these rivers, though the change is not likely to be very material in two or three of these rivers. But even when this is done, the terrain in the immediate periphery of Kailas-Manasarowar will still remain the nidus, or cradle of four of India's largest rivers.

A paper containing the resume of Swami Pranavananda's observations was read at a meeting of the Royal Geographical Society, London, and although it aroused curiously little comment at the time, at this one of the world's most important centres of geographical enlightenment, it is apposite to conclude this note with the remarks made at this meeting by Dr. T. G. Longstaff, the celebrated Himalayan explorer and surveyor. While expressing himself in full agreement with Swami Pranavananda's acceptance of the traditional sources of the four rivers the veteran Dr. Longstaff said, "It savours of impertinence for Europeans to assert their views against the usage of other civilizations". And in this tribute by him to the Swami all acquainted with travel in the Himalayas will heartily concur:

> "Those who have travelled in Tibet must admire the character of the Swami, displayed by his omission of all reference to the hardships he must have suffered during his winter journeys in this inhospitable region."

BLOOD GROUPS OF THE BHILS OF GUJARAT

BY

D. N. MAJUMDAR

(*Anthropology Laboratory, Lucknow University*)

THE Bhils and the Chenchus have been found to be racially akin on the basis of the coefficients of racial likeness worked out from Dr. B. S. Guha's measurements.[1] Otherwise also, the Chenchus are popularly known as the closest relations of the Bhils, but they differ very much in their blood groups. Macfarlane tested 44 bloods from the Bhils of both sexes in the Kannad Taluk of the Aurangabad District in the extreme north-east. She found 31·8 p.c. O, 13·6 A, 52·3 B and 2·3 AB. This result if corroborated should be considered highly significant. "It may be", writes Macfarlane, "that in the Bhils we have one of the reservoirs of group B in India from which it has percolated to higher social castes, for the Bhils have an ancient tradition as soldiers and artisans".[2] In another paper on "Blood Groups in India"[3] Macfarlane has recorded the blood groups of 140 Bhils and she found 18·6 p.c. O, 23·6 p.c. A, 41·4 p.c. B and 16·4 p.c. AB. I do not know where this group was examined, as the reference given in the paper does not mention it. The large incidence of B, 52·3 p.c. in one case and 41·4 p.c. in another, could be explained if we took the Bhils as a highly heterogeneous group, for according to the data available the B percentage is found higher among mixed groups and may have something to do with hybridization.[4]

At the invitation of the Gujarat Research Society and in collaboration with Dr. G. M. Kurulkar, Professor of Anatomy, S. G. S. Medical College, Bombay,[5] I have recently done some anthropological investigations among the Bhils of Gujarat (Panchmahal District) and the bloods of 369 Bhils of both sexes were typed by me. The data from the Bhils give the following percentage distribution: 37 p.c. O, 27·5 p.c. A, 26·0 B and 9·0 AB. Macfarlane's estimate of B concentration could not be corroborated and we have therefore to seek for "reservoirs of group B" elsewhere than among the Bhils. The large amount of B among the Bhils living in the hilly

parts of north-west Hyderabad State, may be due to "inbreeding in an isolated community where one fertile family may have a large effect", as has been suggested by Macfarlane herself in the case of the Paniyans who showed 62·4 p.c. A and 7·6 p.c. B only.[6]

Guha, as we have already referred to above, found close connection between the Chenchus and the Bhils.[1] Photographs of Bhils and Chenchus published by Macfarlane[2] do not show such relationship. The Bhil type was represented by an old man and the Chenchus by a much younger person and comparison is indeed difficult for obvious reasons. As Dr. Guha's data on the Bhils are still unpublished we cannot discuss them. From what we have seen of the Bhils, I think the Bhils of Gujarat do not belong to any aboriginal stock we know of in India. In blood groups, the Bhils do not approximate to any aboriginal group either pure-bred or hybrid. I should think that the time has come when we should revise our entire ethnological nomenclature. The classification of the Bhils with the Kols and Sonthals, I think, has been more for symphony than for fundamental ethnic similarity; the name Bhil, as we are told, is derived from Tamil 'bil' or a bow which is the principal weapon of offence and defence of the Bhils. In ancient Tamil poetry "villavar" (bowmen) refers to the savages of pre-Dravidian stock. It may be that the Dravidian speaking races have given the Bhils their historic appellation on account of the popular use they make of bow and arrows.

The blood groups of the Bhils of the Hyderabad State (Macfarlane) are found to differ from those obtained by me in Gujarat. If the Bhils of Gujarat are racially different from those of the Hyderabad State, then this disparity can be accounted for. Otherwise we have to attribute the disparity to the nature of the samples investigated. As all precautions were taken to render the result free from any technical or methodological defects, the size of the samples may have something to do with this disparity. Unless the size of the samples is statistically significant, conclusions based on them must be regarded as unsafe. Although the standard size of blood group samples has not been agreed upon, it is necessary to exercise some caution in interpreting results. The table below will illustrate the point.

Tribe or Caste	O	A	B	AB
Bhils (Macfarlane) (44) *J.R.A.S.B.* ..	31·8	13·6	52·3	2·3
Bhils (Macfarlane) (140) *Am. J. Phy. Anth.* ..	18·6	23·6	41·4	16·4
Bhils (Majumdar) (369) ..	37·5	27·5	26·0	9·0

[1] Guha, B. S., *The Racial Affinities of the Peoples of India*, 1935, **1**, Pt. 3, Calcutta.

[2] Macfarlane, E. W. E., "Blood grouping in the Deccan and Eastern Ghats," *J.R.A.S.B.*, 1940, **6**, No. 5, Pt. 39–49.

[3] Macfarlane and Sarkar, "Blood Groups in India," *American Journal of Physical Anthropology*, December 1941, **28**, No. 4.

[4] Majumdar, D. N., "The Blood Groups of the Criminal Tribes of the U.P.," *Science and Culture*, 1942, **7**, No. 7.

"The Blood Groups of the Doms," *Curr. Sci.*, April 1942, **10**, No. 4.

[5] Shah, P. G., "Non-Hindu Elements in the Culture of the Bhils of Gujarat." *Essays in Anthropology Presented to S. C. Roy*. Maxwell Co., Lucknow.

[6] Aiyappan, A., "Blood Groups of the Pre-Dravidians of the Wynad Plateau," *Curr. Sci.*, 1936, **4**, 493–4.

CHRONICA BOTANICA

AN extensive list of Institutions, Societies and Research Workers in the pure and applied plant sciences in C. and S. America has been prepared by the Editors of *Chronica Botanica*, in co-operation with the Division of Agriculture of the Office of the Co-ordinator of Inter-American Affairs, Washington, D.C. It has been published in *Chronica Botanica*, Vol. 7, Nos. 2 and 3 (March and May 1942).

SCIENCE AND ART

BY

S. W. SHIVESHWARKAR

(*Deparment of Scientific and Industrial Research, Delhi*)

ALL good science must exhibit a certain amount of artistry and all good art must essentially satisfy certain scientific requirements. It is proposed to discuss broadly the relation of Geometry and Mechanics to Art.

Art begins with drawing inasmuch as Art comprises representation on material objects of some æsthetic subject, real or imagined. By the very definition of Geometry, all drawing is essentially geometrical in the wider sense; Geometry being the study of shape and size, a mathematical method to scrutinize the shapes and sizes of isolates of Nature as perceived by the senses and conveyed to the mind. Persistent use of this method may have the tendency to make it a "second nature" of the mind which will then be incapable of judging whether the impression it has gathered has any independent existence in Nature, whether the regularity of shapes in the Universe is its intrinsic quality or whether the regularity is only a creation of mental imagination due to the geometrical method employed. (We are, of course, not alluding here to the Pure Mathematician who deals with imagined systems such as n-dimensional geometry; to that extent pure mathematics is just a thought rather than a science.) The Artist does not suffer from geometrical thinking because unlike the geometer he eliminates the method of logical deduction and is concerned only with the æsthetic impression that shape and size create on his mind. In his detachment from geometrical methods, he draws more on his own imagination and feeling than on the actualities of Nature. We do not class the photographer as an artist. The photographer is only a geometer. He uses a geometrical apparatus called a Camera and lets his lens do the work which the Artist would let his mind do. Let us now come to the scientist who deals with the particular branch of science which is called Mechanics. We shall call him the Mechanist. The Mechanist goes further than the geometer and studies the equilibrium of pieces of matter if at rest or their motion, if moving. But in spite of these differences in their outlook and methods, there is an essential unity of purpose among the Geometer, the Mechanist and the Artist, *viz.*, to extract and study isolates of Nature. Because of this unity of purpose the view-point of anyone of them has a certain effect on the others.

One such common characteristic is that even when the scientist and the Artist are studying the internal properties of an isolate of nature, they cannot forget the relation to the external world.

For instance, take the case of the Geometer. He commences with his points, lines, and circles and with the help of axioms and logical analysis lays down qualities of the grouping known as "properties" of one or the other of the constituents. But a point as an abstraction or a perfect isolate with nothing else in the picture has no meaning for him at all. It has no "properties". He cannot even say that "it has position but no magnitude," because unless he compared it with some other entity he could not define "position" or magnitude. Magnitude must be in terms of some unit. So also a circle isolated from the rest of the Universe is meaningless. Having no relationship to anything it cannot be interpreted. It is only when the point or the circle is associated with other entities such as lines, chords, tangents, etc., that they have qualities. It is only then that they have a "geometry".

The Mechanist is in the same situation. He takes out a chunk of Nature so to speak and studies its motions and equilibrium in any set of circumstances he wishes to analyse. He then tries to piece these together in a logical way starting from certain laws of nature which he formulates having discovered their universality. He isolates from Nature what he himself experiences, *viz.*, mass, inertia, and force. He knows that force is necessary to change the state of motion of a piece of matter. In other words mass has inertia. By his studies, he can even predict the position of heavenly bodies at any future time. Like the Geometer he is interested in shape and size also because these affect the motions of bodies. But there is a difference. The Geometer is concerned only with the shape and size of the

constituents of the group. He is not interested how the whole group is situated. For instance to the Geometer it may not matter whether an egg is placed on a table on its end or its side. He is concerned with the oval shape only and the properties say of its chords and tangents, etc. To the Mechanist the distinction is vital for on it depends whether the egg will stand or fall or if disturbed from its position will break or not. He is concerned with the Statics and Dynamics of the circumstance.

But consider the Artist. He also draws his stimulus from the world around him as do the Geometer and the Mechanist. He also takes extracts from the real continuum of existence. He is also concerned with form,. movement, force and even mass, because equilibrium and balance are essential to æsthetics. His activities are however primarily social whilst those of the scientist are only in the narrower sense social in that they might provide material for the correct action to be taken for material prosperity of the Society. Like the Psychologist and the Sociologist the Artist focusses his art on the relation of man to his environment, on the activities, the joys, the sorrows that are stimulated in human beings by human beings and nature. In this sense he might depict in art the "spirit" of man. He might detach himself from his objectives and go to a higher level of abstraction but taken as a rational endeavour on his part, Art affects the emotional reaction of social beings with the rest of the human beings. The Artist is most concerned with the world around him. To this extent his work is drawn from the realities of Nature which the Scientist studies on logical basis. The novelty about his work is that he brings social appreciation to bear on his abstractions. Thus although in his work the detailed form may bear resemblance to Nature, the general form need not. The resemblance of the detailed form to Nature is essential to achieve interpretation. It is in this sense that the Artist cannot depart completely from qualities of a scientific nature. It is in this sense that all good science must exhibit a certain amount of artistry and all good art must satisfy certain scientific requirements. It is here that Science and Art are inter-connected.

Instances of such relations are numerous. It is an elementary result in statics that a triangle on a broad-base with its vertex within the base-line remains in stable equilibrium. The stability will suggest that it is devoid of movement. Hence the Pyramids of Egypt convey the idea of time-lessness and eternity. Hence also the teaching posture of Buddha in the Ajanta and Ellora rock-temples with its broad triangular outline with a broad base conveys Nirvana (Supreme Bliss) the eternal hope of man. An obtuse-angled triangle with a tilt forward depicts strain. A man dragging a load with a rope would form such a triangle with the load and the ground.

EXPLOSIVE RIVETS

A NEW use for aluminium is the manufacture of explosive rivets in which a charge of powder takes the place of a riveting hammer for expanding the driven end. The explosive rivet is specifically adapted to the fastening together of metal plates which are accessible only from one side, but will doubtless find much wider application.

The explosive rivet has a cavity in the aluminium shank in which is placed a small charge of a high explosive, which is set off when the rivet is heated up to a critical temperature. The heat necessary is furnished by a special riveting iron—a silver-tipped electrically heated tool held against the rivet head. In about 2 seconds the rivet is heated sufficiently to cause the necessary explosion, which expands the shank of the rivet in such a way as to fasten together securely the metal sheets. The rivets now being made are of aluminium alloy, only ⅛ in. diameter, but the development of larger rivets, up to ¼ in. diameter is proceeding. They are supplied in the age-hardened condition and do not need the careful refrigeration following heat-treatment before use which is necessary with rivets of the same alloy that are used for ordinary clinching.—(*The Times, Trade and Engineering*, Vol. 50, Jan. 1942, p. 36.)

LETTERS TO THE EDITOR

STRUCTURE OF THE BAND SPECTRUM OF PHOSPHORUS AND NUCLEAR SPIN

The band spectrum of phosphorus, as excited in a discharge tube has been photographed with a Hilger large Quartz Littrow Spectrograph and the bands (9, 21), (5, 21), (5, 18) and (4, 18) have been measured. The analysis of their rotational structure has led to the following values of the constants (in cm.$^{-1}$).

$B'_4 = 0{\cdot}2346$ $B''_{18} = 0{\cdot}2799$

$B'_5 = 0{\cdot}2323$ $B''_{21} = 0{\cdot}2736$

$B'_9 = 0{\cdot}2255$

The constant for $v' = 9$ agrees with that obtained previously by Herzberg[1] and also by Ashley,[2] the others being newly obtained. The absence of any perturbations in the rotational structure of the bands (5, 21) and (5, 18) has shown that the perturbations pointed by Herzberg must be only vibrational.

Elaborate quantitative measurements have also been made of the alternating intensities of the rotational structure lines in the case of the bands (5, 21), (5, 18), (6, 22) and (9, 21). The (5, 21) band alone gave an anomalous value 3·3, while for the others, the ratio, on an average, is 3·0. Such a high value (3·4 to 3·5) was obtained for this band also by Jenkins.[3] But the anomaly cannot be ascribed to any effect of perturbations as the (5, 18) band does not show the anomaly and the rotational structure has not revealed any perturbations. The high value is shown to arise from superposition by a faint band.

The intensity ratio leads to a value of $\frac{1}{2}\frac{h}{2\pi}$ for the nuclear spin of phosphorus, as determined by Ashley and Jenkins. Details of the results will be published elsewhere.

K. Narahari Rao.

Solar Physics Observatory,
Kodaikanal,
August 30, 1942.

[1] *Ann. d. Physik*, 1932, **15**, 677.
[2] *Phy. Rev.*, 1933, **44**, 919.
[3] *Ibid.*, 1935, **47**, 783. (Letter).

A PRELIMINARY NOTE ON THE INCIDENCE AND CAUSATION OF GLYCOSURIA IN PREGNANCY

About three hundred pregnant women attending the ante-natal clinic of the Bai Jerbai Wadia Maternity Hospital, Parel, Bombay, were examined. Their diet, as far as it could be gathered from personal history, was in most cases lacking in milk, fruits and green vegetables. The cereal consumed consisted almost exclusively of rice. Glucose was found to be present in the urine of about 30 per cent. of the subjects during the 7th, 8th and 9th months of pregnancy. Glucose tolerance tests of these

glycosuria cases indicated that 99 per cent. were cases of Renal Glycosuria and 1 per cent. of Pancreatic Glycosuria. These Renal Glycosuria cases revealed a low Ca and Vitamin C content in blood although the non-protein nitrogen content was normal. In these cases the percentage of urea in the urine was also found to be within the average normal limits. Administration of suitable doses of calcium and Vitamin C caused a disappearance of glucose from the urine.

Further investigations are in progress.

K. C. BATLIWALLA.

Department of Physiology,
Seth G. S. Medical College,
Bombay,
September 2, 1942.

BACTERIOLOGICAL EXAMINATION OF BLOOD, STOOLS AND URINE OF SUSPECTED CASES OF TYPHOID FEVER*

IN the course of an epidemiological investigation of typhoid fever in Bangalore City, an examination of the blood, stools and urine in such of those cases where the diagnosis was inconclusive has been carried out. Whole blood was cultured only in those cases that were traced in the first or second week of infection; in the other cases culture of the stools, urine, the widal test and clot cultures were done.

Salenite. F. was used as a primary enrichment media for the typhoid group of organisms, the stools and urine being directly inoculated on this media in the field before being sent to the laboratory. Brilliant green bile broth, eosin-methylene blue and Wilson and Blair (Difco Company) were adopted for the final isolation of the organisms.

Blood Culture.—Seventy-eight samples of blood were examined as given in Table I.

Table I shows that in the 16 samples taken in the second week of infection from patients clinically diagnosed as typhoid, the blood culture was positive in 9 or, 52·2 per cent. of the cases. The remaining 3 samples taken in the third week were negative. Of these 9 positive cultures, 6 were positive for *B. typhosus*, 3 for *B. para-typhosus A*, and none for *B. para-typhosus B*.

It may be noted that out of these 9 positives 4 samples had been obtained from those who had developed the infection after inoculation with T.A.B. vaccine, and one from a patient

TABLE I

Bacteriological and Serological Analysis of Blood

Nature of Culture	Total Number Examined	Clinically diagnosed as typhoid	Clinically Definite Cases Days after Onset								Number Positive		
			0—7 days		7—14 days		14 - 21 days		After 21 days				
			Specimens	No. Pos.	Specimens	No. Pos.	Specimens	No. Pos.	Specimens	No. Pos.	T	A	B
Whole Blood Culture	29	19	0	0	16	9	3	0	0	0	6	3	—
Clot Culture	9	6	0	0	1	0	2	0	3	0	—	—	—
Widal	40	25	1	1	16	14	3	1	5	5	17	—	4†

† Positive also for *B. typhosus*.

* The auther is grateful to the Director of Public Health, the Health Officer, Bangalore City, the Medical Officers of the Victoria and Vani Vilas Hospitals and to the Superintendent, Bureau of Epidemiology, for valuable help rendered by them during the course of this investigation.

who was having a second attack of typhoid in 1938 (the first attack being in 1936). In all these cases since the widal test by itself was of no diagnostic significance, culture of the whole blood was of special value in establishing a definite diagnosis of typhoid.

Clot Culture.—Of the 9 samples examined 6 were clinically diagnosed as typhoid. One clot culture was made in the second week, 2 in the third week and 3 in the fourth week. All these clot cultures gave negative results.

Widal Test.—This was carried out on 40 samples of blood, 25 of which were clinically cases of typhoid. Of these 17 were positive for *B. typhosus* and 4 both for *B. typhosus* and *B. para-typhosus B.*

In cases clinically diagnosed as pneumonia, malaria, tumour of the brain, pulmonary or abdominal tuberculosis, or some allied disease, the widal was definitely positive particularly for the para-typhoid group of organisms. In none of these cases was there any history of the patient having suffered from typhoid at any time before or having been recently inoculated with T.A.B. vaccine. In a place like Bangalore where typhoid infection has been prevalent for many years it is likely that a large proportion of the population have suffered from comparatively mild infections as a result of which their blood would contain the specific typhoid agglutinins.

When such people get high fever due to causes other than typhoid, owing to anamnestic reaction, the titre for typhoid group of organisms possibly shoots up so high that we get positive widal in diagnostis titres. It seems therefore, necessary to determine what the natural level of agglutinins for the typhoid group of organisms is amongst random samples of the population in Bangalore City before fixing up the titre for diagnostic purposes. For instance in Bombay City, on the basis of such an investigation minimum titre for diagnostic purpose has been fixed up for *B. typhosus* as 1-250 (formalised suspension) and 1-125 for H. agglutination; for Para A and B infection the titre fixed up is 1 : 25.

Stool Culture.—Of the 103 samples cultured, in seven cases, the specimens from the same patient had been examined twice at a week's or fortnight's interval. The bacteriological analysis of the remaining 96 samples is given in Table II.

TABLE II

Bacteriological Analysis of Stools and Urine

Specimen	Total No.	Clinically diagnosed as typhoid	Days after Onset in Clinically Definite Cases								Positive Biochemically and Serologically				Positive only Biochemically			
			0—7 days		7—14 days		14—21 days		After 21 days									
			No. Exam	No. Pos.	No. Exam.	No. Pos.	No. Exam.	No. Pos.	No. Exam.	No. Pos.	T	A	B	Total	T	A	B	Total
Stools	96	65	1	0	26	14	24	9	14	9	17	2	2	21	5	1	5	11
Urine	48	42	1	0	23	4	9	4	9	0	6	—	—	6	2	—	—	2

Of the specimens of stools cultured from 65 clinically definite cases, 17 proved positive for *B. typhosus*, 2 for *B. para-typhosus A* and 2 for *B. para-typhosus B.* In these cases, in addition to getting typical biochemical reactions, the isolated culture was agglutinable by the specific standard high titre sera and in six cases by the patient's serum also. In 11 cases, however, the isolated culture gave typical biochemical reaction but was not agglutinable by the specific high titre sera.

In a few clinically typical cases of typhoid fever, in which the typhoid group of organisms could not be isolated on culture of the stools, blood or urine, some of the non-typhoid group

of organisms like *Proteus morgani, Pseudomonas pyocyaneus, Bacterium faecolis alkaligenes,* and a few other strains with a typical biochemical or serological reactions were isolated. The possible association of these organisms in the causation of continuous fever required further investigation.

Urine Culture.—During the investigation 50 samples of urine from cases of continuous fever were cultured. Out of these, in two cases the same specimen was examined twice at about a week's interval. The results of analysis of the remaining 48 samples are given in Table II.

Out of clinically definite cases of typhoid, *B. typhosus* was isolated in 6 cases, the paratyphoid group of organisms not being isolated in any of them.

V. N. MOORTHY.

Department of Public Health,
Bangalore,
August 15, 1942.

THE FATTY OIL FROM THE SEEDS OF *MALLOTUS PHILIPPINENSIS*, MUELL. ARG. (NATURAL ORDER EUPHORBIACEÆ)

THE seeds of *Mallotus philippinensis* (commonly known as *Monkey face tree* in English and *Kamala* in Hindustani) on extraction with benzene yielded a thick, transparent light brown oil of drying character. The physical and chemical constants of this oil, which has not so far been investigated,[1] have been determined with the following results:—

Yield of oil in kernels—48·8 per cent.; Specific gravity at 33° C./33° C.—0·9333; Refractive index at 34° C.—1·5156; Acid value—11·3; Saponification value—207·6; Iodine value—157·3; Acetyl value—46·8; Hehner value—96·1; Unsaponifiable matter—1·9 per cent.

A detailed examination of the constituent acids of this oil is now in progress.

BAWA KARTAR SINGH.
BRIJMOHAN SARAN.

Chemistry Department,
University of Allahabad,
August 4, 1942.

[1] Brodie, N., *Bull. Indian Ind. Research*, No. 10, 'Indian Vegetable Oils', 1937, p. 33.

CONSTITUTION OF HIBISCETIN

THE hydroxy flavonol, hibiscetin obtained from the flowers of *Hibiscus sabdariffa,* was shown to be 3 : 5 : 7 : 8 : 3′ : 4′ : 5′-heptahydroxy flavone from a study of its reactions and of the degradation products.[1] This structure has now been confirmed by the synthesis of its methyl ether according to the method of Allan and Robinson.[2] 2 : 4-dihydroxy-ω : 3 : 6-trimethoxy acetophenone has been condensed with trimethyl gallic anhydride and anhydrous sodium trimethyl gallate to produce 7-hydroxy-3 : 5 : 8 : 3′ : 4′ : 5′-hexamethoxy flavone, which on subsequent methylation has yielded 3 : 5 : 7 : 8 : 3′ : 4′ : 5′-heptamethoxy flavone. This methyl ether agrees in all respects with heptamethyl hibiscetin. Experiments on demethylation to yield hibiscetin itself have yet to be carried out.

P. SURYAPRAKASA RAO.

Andhra University,
Guntur,
August 5, 1942.

[1] Suryaprakasa Rao and Seshadri, *Proc. Ind. Acad. Sci.* (A), 1942, **15**, 148.

[2] Allan and Robinson, *J.C.S.*, 1924, 2192.

PHENYLHYDRAZINE ANÆMIA IN RATS

IN the search for a simple method for making experimental animals anæmic for the study of the hæmopoietic action of amino-acids, it was decided to investigate the possibility of using phenylhydrazine. This substance has long been known to have a destructive action on the red blood cells, a fact which has found therapeutic application in the treatment of polycethemia vera, a disorder in which the blood contains an abnormally high proportion of erythrocytes. Apart from ascertaining the conditions under which experimental anæmia could be induced in rats by injection of phenylhydrazine it was found necessary to study the blood picture of such animals in some detail as certain authors claim to have observed an increase in blood concentration due to fluid loss in poisoning by hydrazine and its derivatives [*cf.* Underhill and Karelitz[1] (1923), Bondansky[2] (1924)]. In careful experiments on rabbits

carried out by Long[3] (1925-1926) no such anhydremia was, however, observed.

For experiment, rats weighing about 80 gm. and maintained on a synthetic diet consisting of starch, sugar, casein, butter-fat and salt mixture with supplements of yeast and codliver oil were used. It was found that the animals could be consistently made anæmic by a single intraperitonial injection of 2 mg. (1 c.c. of a 0·2 per cent. aqueous solution) of phenylhydrazine. Commencing from a control period of three days prior to the injection daily determinations were made of the red cell count, hæmoglobin and of reticulocytes until the blood characteristics returned to normal. In view of the claims regarding anhydremia mentioned in the literature two independent methods were used for hæmoglobin determination, *viz.*, the Iron method of Wong[4] (1928) and the Acid Hæmetin method as described in Peters and Van Slyke[5] (1932). The two methods gave results in close agreement The experiments were repeated on several groups of animals, the results on one set of eight rats being given in the accompanying tables. The average values obtained with this group were used for the construction of the graph.

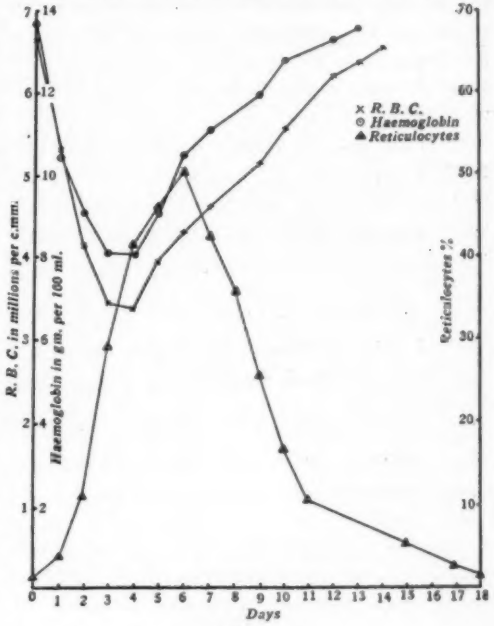

FIG. 1

TABLE I

R.B.C. in million per c.mm.

Rat No.	Days after injection														
	0*	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	6·60	5·33	4·30	3·48	3·40	3·77	4·30	4·60		5·10	5·64		6·38	6·64	6·60
2	6·31	5·51	4·10	3·49	3·48	4·01	4·37	4·71		5·31	5·67		6·20	6·40	6·45
3	6·51	5·60	4·34	4·47	3·46	4·04	4·22	4·51		5·02	5·73		6·21	6·35	6·50
4	6·50	5·31	4·40	3·57	3·43	3·88	4·37	4·80		5·12	5·69		6·30	6·21	6·40
5	6·68	5·10	4·03	3·52	3·50	4·00	4·34	4·70		5·31	5·73		6·45	6·25	6·90
6	6·99	5·01	4·10	3·28	3·03	4·04	4·37	4·50		5·01	5·35		5·95	6·01	6·61
7	6·99	5·25	4·19	3·34	3·41	3·80	4·03	4·20		5·00	5·36		6·01	6·20	6·50
8	6·13	5·01	4·01	3·27	3·29	3·93	4·41	4·76		5·10	5·33		6·00	6·15	6·19
Average Values	6·63	5·30	4·18	3·43	3·38	3·93	4·30	4·60		5·12	5·56		6·19	6·36	6·52

* Averages of 3 days previous to injection.

TABLE II

Gm. Hæmoglobin per 100 c.c. blood (acid hematin method)

Rat No.	Days after injection											
	0*	1	2	3	4	5	6	7	9	10	12	13
1	14·33	10·68	8·93	8·10	8·01	8·80	10·17	11·24	12·22	13·64	13·90	14·10
2	13·28	10·35	8·77	8·28	8·20	9·22	10·70	11·11	12·00	12·64	13·64	13·60
3	14·61	10·91	9·21	8·31	8·10	9·83	11·03	11·19	11·75	12·64	13·50	14·01
4	13·77	11·11	9·88	8·33	8·31	9·43	10·91	11·11	12·00	12·50	13·43	13·50
5	13·53	10·35	8·83	8·21	8·12	8·82	10·70	11·75	12·60	13·64	13·71	13·76
6	13·45	10·76	9·09	7·89	8·00	8·52	9·83	10·53	11·53	11·90	12·50	13·20
7	13·69	10·00	9·14	8·10	7·99	8·82	10·35	10·64	11·53		13·04	13·50
8	12·77	10·17	8·99	7·84	8·00	8·69	10·00	10·71	11·80	12·50	12·40	12·60
Average Values	13·68	10·42	9·11	8·13	8·09	9·02	10·46	11·04	11·93	12·78	13·27	13·53

* Averages of 3 days previous to injection.

TABLE III

Reticulocytes (%)

Rat No.	Days after injection														
	0*	1	2	3	4	5	6	7	8	9	10	11	15	17	18
1	1·15	3·80	10·30	28·60	41·00	45·00	51·40	42·40	34·40	26·00	17·60	10·80	5·30	3·00	1·50
2	·95	3·40	12·00	30·30	41·00	46·00	48·90	43·00	36·10	25·60	16·40	11·00	5·00	2·60	1·20
3	1·00	3·60	10·80	27·80	39·00	46·00	48·80	44·60	36·80	26·00	15·80	10·60	5·80	3·10	1·00
4	1·15	4·00	11·20	29·60	39·90	45·80	49·80	43·80	34·60	25·40	17·60	11·40	6·00	2·20	1·10
5	·95	3·70	10·60	30·40	40·80	46·20	51·40	42·90	35·80	24·10	15·90	10·80	6·10	2·40	1·40
6	·90	4·20	11·00	29·40	42·00	46·40	50·00	40·40	36·80	25·80	15·90	11·10	5·20	2·80	1·80
7	1·05	4·30	11·30	28·80	41·20	45·00	51·40	42·60	38·20	27·00	18·00	10·20	6·30	3·00	1·00
8	1·05	4·60	12·70	30·00	41·40	46·80	52·00	42·00	34·20	26·10	17·20	11·40	6·10	3·10	1·60
Average Values	1·03	3·95	11·25	29·31	41·41	45·90	50·40	42·71	35·86	25·74	16·80	10·91	5·73	2·77	1·32

* Averages of 3 days previous to injection.

It will be seen from Tables I to III and Fig. 1 that the anæmia runs a well-defined and reproducible course in all the animals manifesting itself in a lowered erythrocyte and hæmoglobin content within 24 hours after injection. The decrease in hæmoglobin and R.B.C. follow a parallel course, both reaching their minimal values (about 60 and 50 per cent. of normal respectively) between the third and the fourth day after injection and both being restored to normal on the thirteenth or fourteenth day. With the fall in erythrocytes, there is an increase in the number of reticulocytes which reaches its maximum value of about 50 per cent. on the sixth day. After this there is a gradual fall in their number until the normal value of about 1·1 per cent. is reached at the end of 18 days. During the experimental period the animals maintained their normal health and increase in weight. Nor were any ill-effects discernible if animals after recovery from the anæmia were subjected to a second treatment with phenylhydrazine.

These experiments make it clear that injection of phenylhydrazine provides a simple and convenient method of making experimental animals anæmic for the study of the action of hæmopoietic substances.

The author is very much indebted to Professor M. Damodaran for his valuable advice and help.

K. M. Yeshoda.
University Biochemical Laboratory,
Madras,
August 21, 1942.

[1] Underhill and Karelitz, *J.B.C.*, 1923, **58**, 147–51.
[2] Bodansky, *J. of Pharmacology*, 1924, **23**, 127–33.
[3] Long, *J. of Clin. Invest.*, 1925–26, **2**, 329.
[4] Wong, *J.B.C.*, 1928, **77**, 409.
[5] Peters and Van Slyke, *Quantitative Clinical Chemistry*, 1932, **2**, 668.

OLPIDIUM UREDINIS PARASITIC WITHIN THE UREDIOSPORES OF *HEMILEIA CANTHII* BERK. AND BROOME

The genus *Olpidium* founded by Schröter includes many species which are parasitic within the tissues of plants. *Olpidium Brassicæ* (Woro.) Dang. and *O. Viciæ* Kusano cause diseases of cabbage and *Vicia* respectively, particularly the former causes the damping off disease of the cabbage seedlings. *O. pendulum* Zopf is found parasitic within the pollen of aquatic plants. Other species of *Olpidium* are found parasitic within the mycelium of *Saprolegnia*, algal filaments and others.

Olpidium uredinis (Lagerh.) Fischer is known to be hyperparasitic within the urediospores of many rusts, such as *Uredo airæ*, *Puccinia violæ*, *Puccinia rhamni*[1] and those of *Puccinia coronata* and *P. levis*.[2] In the course of the studies on some of the uredinicolous fungi, the writer observed that many of the urediospores of *Hemileia canthii* Berk. and Broome being hyperparasitised by *Olpidium uredinis*. Collection of the material was made near Talakad, Mysore State. The affected spores are without any cell contents and fail to germinate when placed in moist chambers. The sporangium of the hyperparasite is single-celled (Fig. 1), hyaline, ovate or spherical. As many as nine such sporangia have been noticed within a single urediospore. The

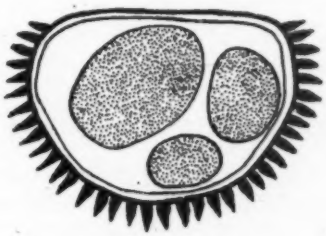

Fig. 1
Urediospore of *Hemileia canthii* parasitised by *Olpidium uredinis*.. × 1800.

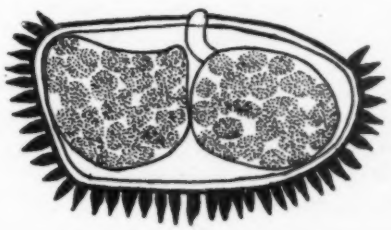

Fig. 2
Formation of zoosporangium, × 1800,

division of the centents of the sporangium into zoospores takes place (Figs. 2 and 3). In one instance the formation of the exit tube which pierces through the wall of the urediospore was observed (Fig. 2). The hypnospore can be differentiated from the sporangium by its

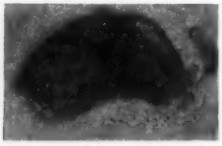

FIG. 3

Photomicrograph of urediospore showing the sporangia of *Oplidium uredinis*.

thick wall, the exospore being smooth and hyaline.

M. J. THIRUMALACHAR.

Department of Botany,
Central College,
Bangalore,
August 2, 1942.

[1] Fischer, A., Phycomycetes in Rabenhorst's *Kryptogamen Flora*, 1892, 2 Aufl., Leipzig, Bd. I.

[2] Arthur, J. C., *The Plant Rusts*, (Uredinales), 1929.

A NOTE ON THE RAINFALL AT MADRAS AND BANGALORE

THOUGH Madras and Bangalore are on very nearly the same latitude, the difference between their heights and the distances from the sea, affect the distribution of rainfall in a characteristic way. September is the wettest month in Bangalore while in Madras, November is the corresponding month. January is the driest month in Bangalore and February in Madras. The number of rainy days is very nearly the same, *viz.*, 57·7 for Bangalore and 57·2 for Madras; but the average annual rainfall at Bangalore is 36·05" only while at Madras it is 49·57"; thus on an average more rain falls at Madras than at Bangalore on a rainy day. Madras gets in the North-East Monsoon 63 per cent. of the annual total while Bangalore gets only 25 per cent., and Bangalore gets 56 per cent. of the annual total in the South-West Monsoon while Madras gets only 31 per cent.

When hourly distribution of rainfall is considered the following interesting details are noticed. If the day is divided into periods of six hours, it is found that at Bangalore the period 6 p.m. to midnight is the wettest part of the day in all the seasons and 6 a.m. to noon, the driest. Madras resembles Bangalore only during the South-West Monsoon; in summer 6 a.m. to noon is the most rainy period and 6 p.m. to midnight the driest period while during the North-East Monsoon season midnight to 6 a.m. is the wettest period and noon to 6 p.m. the driest period. The difference is probably due to conditions of instability developing over land masses towards the evening and early hours of the night and over the sea towards late hours of the night and early hours of the morning.

It is also found that rainfall per rain-hour at Madras is generally greater than at Bangalore in all the seasons.

C. SESHACHAR.

Central Observatory,
Bangalore,
August 20, 1942.

THE VERTICAL AND HORIZONTAL SHRINKAGE OF BLACK COTTON SOIL AT MANDALAY, BURMA

WHILST investigating the cause of the excessive and continual warping and cracking of buildings constructed in Mandalay, Burma, an endeavour has been made to trace the Clarke* buckling effect of the substrata during expansion and contraction of the clay under variations in moisture content.

Mandalay soil resembles a black cotton soil, and is slightly calcarious and alkaline. It possesses a massive† columnar structure and it was, therefore, thought that vertical and horizontal contraction of the natural elements during drying might be unequal and hence ultimately

TABLE I

Showing percentage contraction and loss of moisture of samples collected from building compounds on drying from their natural moisture content

SITE	Original moisture content% dry wt.	Moisture content after "air drying" at app. 50% R.H.	Lineal shrinkage % (Average of 12 readings)		Ratio of horizontal to vertical shrinkage
			Horizontal	Vertical	
1. Provincial Police Training School ..	8·07	5·81	2·10	2·09	1·01
2. District and Sessions Judge's Quarters ..	11·81	5·79	2·52	1·45	1·75
3. Office of the S.D.O., P.W.D. ..	11·20	5·59	3·13	2·62	1·16
4. Office of the Deputy Director of Agriculture	9·96	3·95	1·64	1·54	1·07

TABLE II

Showing percentage contraction and loss of moisture of samples collected from building compounds on drying after artificial in situ *watering*

1. Provincial Police Training School ..	14·28	6·11	2·66	2·29	1·16
2. District and Session Judge's Quarters ..	17·34	6·30	4·87	4·80	1·02
3. Office of the S.D.O., P.W.D. ..	21·57	5·28	2·09	1·59	1·31
4. Office of the Deputy Director of Agriculture	16·75	4·63	2·37	2·16	1·10

lead to the buckling of the soil and help to explain the dynamic sinusoidal curves of building deflection.

To test this, approximately 6" soil cubes were extracted from four different places, from one to two miles apart, and from a depth of 1½' to 2'. From each site cubes were taken at two different moisture contents—at the dry weather natural moisture content and at a higher moisture content after artificially watering the soil *in situ*.

As the cubes dried the vertical and horizontal contractions were measured from the variation in the distance between pins placed, in each of the four vertical faces of the cube, at approximately 10 cm. apart. Each measurement reported below is a mean of 12 lineal measurements. In future work some more accurate method of measurement is necessary.

Notes.—At District and Session Judge's quarters:—Approximate clay content 60·0 per cent; colloidal clay 49·0 per cent.; S/R 2·68. Approximate replaceable bases:—
CaO, — 24·75 m.e./100 gm. air dry soil; MgO, 17·50 m.e./100 gm. air dry soil; Na_2O, 2·25 m.e./100 gm. air dry soil; K_2O, 0·28/100 gm. air dry soil.

Although the data given are not very conclusive and contain some anomalies, it nevertheless appears that there is a tendency for the horizontal contraction to exceed the vertical contraction.

As the replaceable bases vary considerably in the black cotton soil, future work on similar

soils, should include for testing predominantly monionic Na and Mg samples.

A. T. SEN.
F. L. D. WOOLTORTON.

Dacca University,
Ramna, Dacca,
September 20, 1940.

* G. R. Clarke, *The Study of Soil in the Field*, 1938, p. 93, Clarendon Press.

† Massive columnar structure of approximately hexagonal figures, about 4′ in diameter, is formed in dry weather but strictly speaking there is no obvious macro-structure.

VELOCITY OF LONGITUDINAL TRANSPORT AND TRANSEVERSE TRANSLOCATION OF ROOT-FORMING HORMONE IN IMPATIENS

IN continuation of our work[1] on induced root formation in Impatiens, we have found the rate of translocation of the internal hormone to be 1·8 mm./hr. at the apical region, 2·4 mm./hr. at the basal region and 2 mm./hr. throughout the stem. The above rates were calculated as follows:—

Lanolin paste of 1 per cent. β indol acetic acid was applied to similar plants at the apical, central and basal regions of the stem and the time of root formation and the distance from the leafy top to the region of application of the paste gave the required results.

Fig. 1 *a* shows the root induction by 1 per cent. β-indol acetic acid lanolin paste on the defoliated half of the split stem, thereby demonstrating that the internal hormone has been transversely transported across the stem below the split from the non-defoliated half of the split stem. Fig. 1 *b* shows a split plant which has been treated simultaneously on both halves with root formation on the foliated half of the stem only, thereby indicating that the internal hormone has been arrested on the foliated half and consequently inhibiting root formation on the defoliated half. Application of the paste to a completely defoliated stem but supplied with solutions of sugars and vitamin B_1, does not induce root formation which again indicates that the defoliation has rendered the stem devoid of the natural internal hormone.

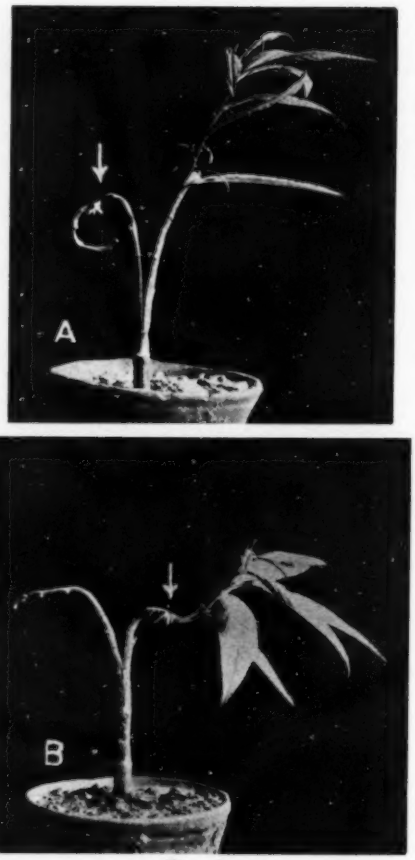

FIG. 1

Rooting responses in split stems of Impatiens

A, defoliated side treated with 1% indole acetic acid (note root formation on the defoliated side indicated by arrow). *B*, defoliated and leafy sides both treated with 1% indole acetic acid (note root formation only on the leafy side indicated by arrow).

The detailed paper will be published in the *Transactions of the Bose Research Institute.*

B. K. DUTT.
A. GUHA THAKURTA.

Bose Research Institute,
Calcutta,
July 29, 1942.

[1] Dutt, B. K., and Guha Thakurta, A, *Trans. Bose Res. Inst.*, 1939–41, **14**, 73–89.

A METHOD OF SECTIONING THE GAMETOPHYTES OF SOME LIVERWORTS AND PTERIDOPHYTES

CONSIDERABLE difficulty is often experienced in cutting smooth sections of many terrestrial and sub-terranean gametophytes. The following method was evolved to overcome this difficulty:—

(1) Fix the material in Formalin-acetic-alcohol or Nawashin's fluid. Wash with 50 per cent. alcohol in the former case and water in the latter.

(2) Run up to 70 per cent. alcohol and remove as much of the sand as is conveniently possible by means of a camel-hair brush.

(3) Treat with 5 per cent. HF in 70 per cent. alcohol—3 to 5 days—keeping the material in specimen tubes having a thick coating of paraffin on the inside. This is done simply by dipping the vial 2 to 3 times in melted paraffin and pouring it out.

(4) Wash out HF by repeated changes with 70 per cent. alcohol.

(5) Run up through the alcohol and xylol series and imbed in paraffin as usual.

(6) Soak the blocks in water for a week and cut at desired thickness—6 microns or above.

The cell structure was not damaged in any way for morphological or embryological studies. Good staining was obtained with both Safranin-Fast Green and Iron-Hæmatoxylin. The HF merely dissolves the finer sand particles that persist after the preliminary cleaning in step 2.

It is hoped that other botanists will try this method and report if cytological details are appreciably affected by the action of HF.

I am greatly indebted to my teacher, Dr. P. Maheshwari, who suggested the method for a trial.

BALWANT SINGH.

Biology Department,
Dacca University,
August 11, 1942.

BITTER PRINCIPLES OF THE NEEM OIL

IN connection with the note on this subject by Siddiqui, recently published in *Current Science*,[1] attention may be drawn to a paper with the above title published in the *Indian Journal of Pharmacy* by Murti, Rangaswami and Seshadri[2] in October 1940. This paper seems to have escaped the notice of the author of the note in *Current Science*. In it, Murti *et al.* have clearly anticipated the mild methods of continuous extraction with warm alcohol and fractional separation of the crude extract by the use of organic solvents and they have employed these methods in the examination of the oil and the oil-cake. The most important observation was regarding the nature of the solid deposit obtained by allowing the oil to stand for a long time. This contained all the quantity of the bitter principle originally present in the oil. It could be separated into two definite fractions A and B using benzene, and substances of the same characteristics were obtained from the three sources mentioned above, *viz.*, the oil, the oil-cake and the deposit. Though they could not be obtained in a crystalline form with well-defined melting points and hence could not be given definite names, they seemed to have constant composition and properties. They were both sulphur-free, non-glucosidal bitter substances devoid of any odour. They were insoluble in water, soluble in alcohol and had reducing properties. Substance A, which had the empirical formula $C_5H_7O_2$ was soluble in benzene, whereas B with the empirical formula $C_4H_7O_2$ was insoluble in that solvent. When tested on earthworms and fresh-water fish, they exhibited no toxic properties in a concentration of 1 in 1000.

The components now described by Siddiqui seem to be, in general, of the same nature as the substances A and B. The two minor components, nimbin and nimbinin, are described as being sulphur-free, neutral and water-insoluble just like A and B. There is, however, some difference since nimbin and nimbinin are said to be crystalline compounds with sharp melting points. Further, nimbin is

reported to have a higher carbon content, 66·6 per cent. as against 61·3 and 54·3 per cent. obtained for A and B respectively. The major bitter component nimbidin, however, is said to contain probably sulphur also and thus differs from substances A and B, though it is also amorphous. In the earlier work of Murti *et al.* it was stated that though the crude bitter solid contained sulphur, it disappeared in the course of purification and hence they felt that the sulphur-containing impurity was very small in amount.

It may perhaps be right to conclude that the bitter principles of neem oil are of complex nature and not unlike the active components of such well-known bitters as quassia and gentian.

S. RANGASWAMI.

Andhra University,
Located at Guntur,
August 5, 1942.

[1] Siddiqui, *Curr. Sci.*, 1942, **11**, 278.

[2] Murti, Rangaswami and Seshadri, *Ind. Jour. Phar.*, 1940, **2**, 206.

OMISSION of the reference is regretted. It was due to the fact that the paper in question was published in a recently started *Journal of Pharmacy* and came to my notice only through the chemical abstracts[1] after the publication of the note on the bitter principles of Neem oil. Due reference would have been made to the work in the detailed communication on the subject.

Extraction of Neem oil with alcohol and isolation of water insoluble, neutral and acid bitters from the alcoholic extract, with the help of dilute alcohol and other solvents, has been already referred to by Dymock.[2] The results obtained there or now by Seshadri *et al.* show the limitations of this mild method. The success of the procedure employed in the isolation of Nimbin and other products communicated in the note in *Current Science*[3] is demonstrated by the uniformity of the isolated products and their yields. The details of this process will be dealt with in a subsequent communication.

With regard to the substances A and B obtained by Seshadri *et al.*, it will be noted that they are amorphous powders which decompose at 115 and 110-115° respectively. B, moreover, melts at 72°, prior to decomposition at 110-115°. Nimbin and Nimbinin, which are definite crystalline substances melting at 205° and 192° respectively, cannot, therefore, be confused with either of them. As far comments on Nimbidine or on the relationship between the active components of Nim and gentian or other bitters, it will be more appropriate to discuss them at a later stage of the investigations, which are now in progress.

S. SIDDIQUI.

Laboratories of the Director,
Scientific and Industrial Research,
University Buildings,
Delhi,
September 19, 1942.

[1] *Ame. Chem. Soc. Abst.*, May 1942, p. 2685.

[2] *Pharmacographia India*, 1890, **1**, 327.

[3] *Curr. Sci.*, 1942, **11**, 278.

REVIEWS

The Photochemistry of Gases. By W. A. Noyes (Jr.) and P. A. Leighton. American Chemical Society, Monograph Series. (Reinhold Publishing Corporation, New York), 1941. Pp. 475. Price $10·00.

The mechanism of reactions in gaseous systems has not proved as simple as the pioneers in the field of chemical kinetics hoped. Energy of activation, chain reaction, accelerating and retarding influence of impurities, wall reactions—all these make difficut a correct interpretation of the course of a chemical process in homogeneous gaseous systems. Investigations during the last two decades have thrown considerable light on the subject, and we have now many well-established principles to guide us in this field.

The photochemistry of gases deals with a special branch of this subject where the atoms and molecules that start the reaction are activated by absorption of radiant energy. It is now clearly understood that semi-quantitative observations rarely supply data which are of much value in unravelling the hidden mechanism of a photochemical reaction. In Chapter II of the book, a clear exposition is given of the modern technique for experimental study of photochemical reactions. One cannot fail to be struck by the advance that has been made since the old days of Bunsen and Roscoe's actinometer. Chapter III deals with spectroscopy in relation to photochemistry. Spectroscopic study of many diatomic molecules has been rewarded with significant results. Energies of dissociaiton can now be calculated, and insight obtained into the states of the atoms formed by the dissociation of molecules. A photochemist must study absorption spectra, but unfortunately even now such studies tell him too little about the type of reaction which may be expected. Chapters IV and V deal with photochemical kinetics. The quantum theory provides a connection between energy absorbed and matter transformed, but its strict application is limited to a few simple reactions. The classic work of Polyani on chain reactions initiated by sodium atoms has motivated much of photochemical work in which the reaction is induced by photo-excited atoms. Thus reactions sensitized by mercury, zinc, and cadmium atoms have been exhaustively discussed. But as the authors point out, even the mechanism of the mercury sensitised hydrogen oxygen reaction is not known with certainty. Chapter VI deals with the photochemistry of gases involving absorption of radiation by diatomic molecules. Here the gaps in our knowledge are being continually narrowed down. But it still happens, that the experimental observations of one worker are not substantiated by another. Thus in the photobromination of double bonds, the authors take it for granted, that the concentration of the acceptor organic molecule has no influence on the velocity of reaction which is not confirmed by observations in the reviewer's laboratory. Where facts are disputed, there cannot be much unanimity of opinion as regards their interpretation. But that is the way that all progress is made!

The appendices contain a very valuable collection of all important references on the subject. The reactions have been classified and tabulated, and the probable absorbing molecules indicated in italics. Short remarks about the quantum yield and the mechanism of each reaction and a complete bibliography of authors are features which will be very welcome to those who are interested in the study of the subject.

The authors are to be congratulated on a balanced and up-to-date review of a subject which is rapidly growing in importance. What is more, they have indicated in many cases, the directions in which more accurate quantitative data are to be collected in order that a unique solution of a photochemical mechanism may become possible.

J. C. G.

A Short History of the Plant Sciences. By Howard S. Reed. (Waltham, Mass.: the Chronica Botanica Co.; Calcutta: Macmillan & Co., Ltd), 1942. Pp. 320, 37 Figs. $5.00.

"Work on the history of a subject is inevitably a reflection of the interest of the writer." Indeed, no botanist today can claim to keep abreast of the progress of the

plant sciences on all the expanding fronts. But in a book with this general title, even the warning uttered in the Preface fails to prepare the reader for the large gaps one actually finds. Here is a list of the subjects which the author leaves practically untouched: systematic botany (except in reference to the early systems of classification), phylogeny, genetics, plant breeding and evolution, palæobotany, the whole field of plant response, enzyme action and respiration, the water-soluble pigments, ecology, hormones, experimental morphology, forestry, vernalisation and the light requirements of plants. This is by no means a complete list,—and the book is intended for the guidance of the average graduate student in the universities.

These omissions would be considered serious enough to make the title of the book a misnomer, were it not that in the first half of the work the author traces the general trend of botany down to about the middle of the nineteenth century. In the second half the treatment is subject-wise and restricted to a few selected branches: gardens, plant geography, morphology, cytology, some aspects of metabolism, mycology and plant pathology. In these later chapters the emphasis is mainly upon recent work which in places is treated in far greater depth than the average graduate student would be able to fathom. The author too often retails a series of names and dates with brief statements of the results of individual investigations many of which, however important they may be as brick and mortar for building into the structure, by no means stand out as features in the edifice of botany. This mode of treatment is excellent for the specialist and research student; for the avowed purpose of this book it is disastrous.

In a short history of the plant sciences for the use of graduate students one expects a balanced and readable story of the main lines on which progress has been achieved during the centuries down to our own day. It would, therefore, have been preferable if the style of the first half of the work had been pursued to the end, indicating in broad sweeps how the last four or five decades have diverted enquiry into unexpected channels and opened up new vistas for research, transforming almost the whole trend of botany.

The first half of the book is distinctly better planned, and interestingly written. But in two fascinating chapters on the plant lore of the ancients, where Egypt and Assyria, Greece and Rome, China and early America are all adequately treated, one looks in vain for a bare mention of ancient India which was certainly well abreast of the times and gave much that the West has assimilated, though not always gracefully acknowledged. Through centuries of experience and cultivation the Hindus had accumulated a knowledge of plants, on the whole admittedly utilitarian but, even so, unsurpassed in their day; and they based upon it a system of dietetics and medicine which has stood the test of time. What Professor Reed calls, in Chapter IV, the Retrogressive Period was, of course, retrogressive only so far as the occidental nations were concerned. During this period, as he himself says, in China herbals and monographs of distinction were written, some of them comparing favourably with those of modern times. This period saw also the extraordinary spread of Muslim influence which preserved in translations much of what ancient Greece had discovered, developed and practised pharmacy to a high state of culture, and spread this knowledge into Europe itself. At Cordova the Moors laid out, as early as the 8th century, one of the oldest botanic gardens in the world. This same period also overlapped the heyday of Hindu civilisation when the Ayurvedic system of medicine was developed, from which numerous vegetable drugs indigenous to this country have been adopted by Western practitioners for centuries past. Is it fair to call this period a retrogressive period in the history of the plant sciences?

One cannot help feeling that the book, in spite of several useful features, suffers from a lack of proportion and of that width of outlook which should mark the responsible task of the historian.

The work is remarkably free from misprints, and several of the illustrations reproduced from classical works will enhance its interest. On page 150 a sentence in para 6 has been duplicated; on page 165, line 8, "Chrisman" should be "Christman".

B. SAHNI.

The Cytoplasm of the Plant Cell. By A. Guilliermond. Authorized translation from the unpublished French MS. by Lenette Rogers Atkinson. Foreword by W. Seifriz. (Waltham, Mass: The Chronica Botanica Co.; Calcutta: Macmillan & Co., Ltd.), 1941. Pp. 247, 152 Figs. $4.75.

This important work, written by an acknowledged authority, summarises our knowledge of a subject which has undergone a remarkable development during the last thirty years, largely through the labours of the author himself and his school. As stated, the aim here is a morphological study of the cytoplasm, rather than an enquiry into the physiological activity of the cell: the latter aspect borders upon the domain of physical chemistry.

After a brief historical sketch of our knowledge of the cell, beginning with Robert Hooke's discovery of the honey-comb structure of cork, the author says that for solving the problem of cytoplasmic structure it is essential to employ the special mitochondrial technique (described on p. 57), supplemented by the use of the ultramicroscope and micromanipulator, vital staining and examination *in vivo*. Most ordinary fixing reagents, which contain alcohol and acetic acid, destroy the lipides of the chondriosomes and render these bodies invisible —a fact which explains why they had so long escaped observation except by a few cytologists.

A short chapter (II) defines the strictly living contents of the cell (cytoplasm and nucleus, chondriosomes and plastids) as distinct from the non-living (cell-wall, vacuoles, lipide granules, inclusions like starch, crystals, etc.). Chapter III stresses the correctness of Dujardin's classic description of the cytoplasm based upon a study, now over a hundred years old, of the living substance of the infusoria: like the latter, the plant's cytoplasm is a perfectly homogeneous substance, showing none of the structures variously described by later observers as reticular, fibrillar, alveolar, granular or emulsion-like. The other physical and physiological properties of the cytoplasm are briefly discussed: its viscosity, torsional elasticity, density and irritability; its power of forming a peripheral layer (the ectoplasm) which is denser, more refractive and richer in lipides than the endoplasm but which, contrary to earlier belief, cannot be regarded as a morphological membrane nor differentiated by staining; lastly, its strange property of allowing passage to certain basic dyes, *e.g.*, neutral red and cresyl blue which, however, cannot stain the living cytoplasm nor the chondriosomes or plastids but accumulate only in the vacuoles.

Chapters IV and V are concerned with the constitution and physical chemistry of this complex colloidal system of protein and lipide molecules in a watery medium holding minerals in solution. Then follows the strictly morphological part of the book which relates largely to the special contribution of the Guilliermond school. Chapters VI to XIX describe the structure and rôle of the plastids and chondriosomes; the mysterious (and to some cytologists still improbable) relation between the chloroplasts and chondriosomes; the vacuolar system, the Golgi apparatus and other cytoplasmic formations; the lipide granules and, finally, the alterations produced in the cytoplasm by physical and biological agents such as X-rays, various salts, and parasites. The concluding ten pages give a full summary of the results. Of about 540 works cited in the Bibliography the vast majority have appeared since the year 1910. It was about this time that the discovery or perfection of certain techniques, the ultramicroscope, mitochondrial methods, vital staining, the micromanipulator and microcinema, enabled observers satisfactorily to stain the elusive chondriosomes and to examine them critically in the living state. Chondriosomes had already been demonstrated in plant cells by Meves as early as 1904, but the rapid development of the whole subject with the startling discoveries by Pensa (1910), Lewitsky (1911) and Guilliermond (1911), which suggested a close genetic relationship between the chloroplasts and chondriosomes, shows convincingly how in the history of science technique sometimes dominates discovery.

It is impossible, in this short space, to do justice to the mass of observations brought together in this valuable book; and most of them have no doubt been reviewed individually by others. But the highlights of the combined picture now presented are:—

(*i*) The cytoplasm is a homogeneous substance in the plant cell, as it is in the animal.

(*ii*) Except in the bacteria and blue-green algæ, it holds minute living bodies, the chondriosomes, sometimes called chondrioconts when they are rod-like, mitochondria when dot-like. Originally regarded as artefacts, the chondriosomes are now known to divide and change their form, showing a striking resemblance with bacteria in their size, shape and staining properties. This resemblance we now know to be purely deceptive; the chondriosomes are not symbiotic bacteria, as they were once believed to be. For one thing, they do not respond to the centrifuge as do bacteria within the same cell.

(*iii*) The origin of the chondriosomes is still a mystery. Possibly, as Lewitsky suggested, they arise by differentiation from the cytoplasm, but they have never been observed to arise *de novo*; they most probably pass on from cell to cell during division.

(*iv*) The plastids of green plants are only transformed chondriosomes. During the development of mature cells from meristems they have been found to arise by differentiation from some of the chondriosomes which become enlarged and are able to manufacture chlorophyll and starch. Conversely, the plastids have been observed, at certain stages in the life-history of green plants, to become smaller and smaller, to lose their chlorophyll, and finally to revert to the inactive form as chondriosomes. These transformations may be repeated in both directions several times in a life-history.

(*v*) "Nothing is positively known about the rôle of the chondriosomes". Like the plastids to which they give rise, they appear to be the seat of important surface phenomena in the metabolism of the cell, but the exact nature of these processes is shrouded in mystery.

(*vi*) The aleurone grains of seeds are only dehydrated and condensed vacuoles. On germination they take up water and swell up into vacuoles which contain a more or less concentrated colloidal solution capable of being shown up by vital stains, like the aleurone grains themselves.

(*vii*) The vacuoles probably arise *de novo*, through absorption of water by colloidal granules secreted by the cytoplasm.

(*viii*) The fungi possess chondriosomes but no trace whatever of plastids, even of the colourless type. Are they, in their origin, algæ dispossessed of their chlorophyll? What is the relation of the Cyanophyceæ, in which no trace is found either of chondriosomes or of plastids, with the rest of the algæ? Perhaps the non-green races of the Flagellata will help towards a solution of these questions. But the bacteria still stand quite apart, and baffle all attempts to line them up with the rest of the plant world. Are they plants at all?

(*ix*) What happens at death? You watch an apparently healthy cell, with only its vacuole stained in neutral red. Everything seems normal, but abruptly the stain leaves the vacuole, and colours the cytoplasm and nucleus. The change that has come about, expressed in this innocent way, must be a change of vast magnitude. What is the nature of this change? What is the mechanism of the vital processes that have now ceased? The narrowing down of this gap in our knowledge is the concerted aim of the morphologist, the cytophysiologist and the physical chemist. B. SAHNI.

Food—the Deciding Factor. By Frank Wokes. (Penguin Special No. S. 87. Penguin Books Co., London), 1941. Pp. xi + 144.

During the last few months, the public is becoming increasingly alive to the necessity of a well-planned and equitable food policy for the world as a whole. Eminent scientists and economists of Britain are ventilating their views on this subject through the colums of *Nature*. It is believed that the adoption of a sane and humane food policy would be helpful in avoiding international conflicts which have become so dreadfully frequent.

In a Penguin Special the question of Food, which represents one of the most important deciding factors in the successful prosecution of a world war, is discussed by Frank Wokes in all its aspects. Morale on the Home front is as important as the offensive spirit on the battle-field and maintenance of both these essential qualities is intimately

bound up with the nutritional state of the two classes.

War-time food economy necessitates rationing and successful scientific rationing demands an intimate acquaintance not only with the principles of nutrition but also with the nutritional and vitaminic composition of the available foods. This fundamental knowledge and data are to be found in the book under review. In a series of seven lucid chapters, the author has dealt with the energy value of foods, the food values of starches, sugars and fats, the body-building values of foods, the value of mineral salts, the vitamin values of foods, losses of food value and the food value of dishes and diets. There is a descriptive Appendix of "Tables of food values". While the book is primarily intended to help the solution of the problem of food imposed on England by the war, the ideas developed in the book will prove helpful in the building up of a new world in which food will still remain the main deciding factor. This little book which is within the reach of every one, will receive the wide circulation it deserves.

V. S. G.

Reference Service and Bibliography. Vol. 1: *Theory*. By S. R. Ranganathan, M.A., L.T., F.L.A., and C. Sundaram, B.A., 1940, pp. 642. Vol. 2: *Bibliography of Reference Books and Bibliographies*. By S. R. Ranganathan, M.A., L.T., F.L.A., and K. M. Sivaraman, B.A., 1941, pp. 511. (Madras: Madras Library Association; London: Edward Goldston.) (n.p.).

These two volumes, it is hoped in the preface by the Madras Library Association, will help libraries in India and elsewhere to organize their work in an efficient, scientific and serviceable way. These are welcome additions to the library literature in the country. Skilfully have the authors traced the genesis and expounded the what, why and how of reference service in Parts 1-3; Part 4 encompasses the whole field of bibliographies including the subject of bibliography or "reference bibliography" as the authors prefer to call it. Vol. 2 is a bibliography to Vol. 1, so to speak.

It may be surprising for many to learn how helpful and informative can the library service be in various fields of knowledge if it is equipped with reference staff. With this background the authors have painted a splendid picture that is just what the titles of the two volumes indicate. The skill of bibliographical research, keen discernment of a librarian *savant*, analytical and interpretative ability of a scholar, and creativeness of a thinker, have all been deployed in penning the picture. Books, institutions, men, memories, incidents in day-to-day library routine, causes and effects, have been searched out, evaluated, and combined, with the result that the two volumes have a wide appeal to anyone who has had contact with a library or who is interested in problems of library service.

That the authors' exposition of the art of reference work is academic as well as practical is seen throughout the work and particularly in the assortment of problems which, with their worked out solutions, fill a number of pages of the pleasingly unorthodox Vol. 1. This book is also unique in the emphasis it places on indological allusions so that the truth of the subject-matter may be feelingly realized by the Indian reader. In this volume the authors put forth the thesis that reference books as a rule are "rather treacherous" and reference service is therefore not a *service de luxe* but a necessity—for guiding the unwary reader through the so-called ready reference works. In the *why* section, a vista of reference books has been opened before the reader, and each book has to bear the brunt of the authors' critical genius. This section is educative for educationists and librarians alike, although it cannot be said to be the last word so far as highly specialized and scientific matter is concerned.

The voluminous flow of pages of lucid, racy, persuasive style is remarkably free from transcription blemishes except on pages 213, 254 and 543 of Vol. 1 and on page 212 where the hog idiom has been pierced by a through. Perusal of foreign titles, however, leaves in general an uneasy feeling owing to their shortcomings of accentuation. Many readers would wish that the valuable references in footnotes were accompanied by names of publishers.

These minor points are not intended to detract from the general interest or message of the composite treatise. It assembles a vast amount of information which the ordinary user might find difficult to acquire.

This makes the work a reference work on reference works. It is adequately indexed, conveniently arranged for reference, and articles are decimally numbered. Throughout the work the reader is struck by the scholarship, personality and humanity of the authors.

The volumes will be profitably read by staff and users of libraries. They show librarians the way of making their service more efficient, give the more ambitious members of library staff an incentive to do reference service, and enable the reader to find his way about in libraries with a quiet confidence in the domain of reference books.

It is to be earnestly hoped that the treatise will contribute to bring about in this country the recognition—hardly nascent at present—that reference service in libraries really has the advantage claimed for it; and that quite independent of a thorough organization of library catalogues and other illuminating guides such as maps, charts, readers' handbooks, etc., modern reference service is a specific requirement if the five primordial laws of library service enunciated and expounded by the senior author in a monumental work published earlier in the same Series are to be satisfied.

G. T. KALE.

The Problem of the Pure Teak Plantation. By M. V. Laurie, M.A., I.F.S., and A. L. Griffith, M.A., M.Sc., I.F.S. (Manager of Publications, Delhi), 1942. Price Rs. 3-10 or 5*sh.* 9*d.*

The technique of raising teak plantations has been thoroughly worked out by foresters in India and every year some 6,000 acres of artificial teak plantations are being added on to the forest estate of the country. At the same time, however, an uneasy feeling has prevailed amongst a section of the professional circles that all is perhaps not well with these plantations; that the promising early growth of these pure crops may later be attended with unexpected and grave consequences such as, for example, the deterioration of the soil—the ultimate capital of all forestry enterprise; that, in short, the dividend from the pure teak plantation may not be worth the depreciation in capital value. These misgivings found expression at the periodical Sylvicultural Conferences at Dehra Dun and the 1934 Conference opined that the time had come for revising the existing bulletin on the subject (Bulletin No. 78). Undertaking this revision, the present authors have compiled and interpreted the available data with commendable thoroughness, having cast their net very wide to garner the knowledge and experience of the Indian provinces, some of the Indian States and notably also of the Forest Research Institute, Buitenzerg, Dutch East Indies.

Every one of the charges against the pure teak plantations and the possible mistakes in their past management have been examined in detail. The suggested remedies are then considered. Finally, the authors conclude that "the case against pure teak as a general proposition has not been established and that from the purely economic point of view, the value of teak timber is so much greater than that of any other species likely to be grown with it, that relatively poor teak is almost always a sounder financial proposition than any other possible alternative". This, so far as it goes, is reassuring but the critics of the pure teak plantation can justifiably point out to chapter VI of the Record where the authors give a list of points on which the existing data, being either scanty or unreliable, do not warrant generalisations. This list includes such important subjects as soil deterioration, quality of the timber, heredity factors and the regeneration of the *second* rotation. These factors, it will be noticed, are not amenable to the mere expression of subjective opinions (however competent and experienced the holders of such opinions may be) but demand prolonged experimental work and statistical interpretation.

This book with its eight plates of uniformly excellent photographs is a clear statement of our present state of knowledge and ignorance of the pure teak plantation in India. It forms an admirable introduction to all those who have to manage or would design further experiments on the teak plantation in its many aspects.

SCIENCE AND THE WORLD MIND

Science and the World Mind. By H. G. Wells. (The New Europe Publishing Co., Ltd., London), 1942. Pp. 63. Price 1*sh.*

MR. H. G. WELLS was born in 1866, which makes him 76 in 1942. He writes as vigorously to-day as he did forty years ago. In the pamphlet "Science and the World Mind", which was presented to a Conference organised by the British Association for the Advancement of Science meeting in London in September 1941, he repeats, and acknowledges that he repeats, certain statements about the world and mankind that he has made over and over again within recent years. Yet even the reader who is familiar with Wellsian ideas is not bored; on the contrary, the argument seems to gather force with each repetition. A man who is told by his doctor that he will be dead in six months unless he changes his manner of life may be truculent and incredulous, but will scarcely dismiss the warning with a yawn.

Mr. Wells' world picture is deeply coloured by biological concepts. The gist of the pamphlet is approximately as follows:—

Homo sapiens is a species belonging to the order of primates. So far, biologically speaking, the family Hominidæ included in that order has not been very successful; five of its six known genera or species are extinct and there may be several other species represented to-day only by scattered teeth and jaw-bones in Upper Pliocene or Lower Pleistocene deposits. "The record of the past", remarks Mr. Wells, "is on the whole against the idea of any survival whatever for the human strain. In the past, dominant orders, groups and species have generally vanished from the earth at the very crest of their domination. It is an old-fashioned ecological misconception that they have been competed out of existence. They have simply failed to adapt."

Man is failing to adapt. He cannot control the forces he himself has brought into being. He has abolished distance, he has made it possible for events to be known simultaneously throughout the world. With his knowledge and technical skill he can make the world produce abundance for all, or, alternatively, he can produce (and is producing) enough explosives to blast himself out of existence. In face of the possibilities of progress or destruction which confront him, he cannot rid himself of habits of mind appropriate enough in the days when the horse provided the most rapid means of locomotion and the spear was the most lethal weapon. If he does not adapt himself to changing conditions, and that quickly, he may "become one or a series of degenerating sub-human species, or end altogether".

What does the adaptation of *Homo sapiens* to the new environment which science has created involve? Mr. Wells enumerates a number of necessary adjustments: Federal control of the air and international transport; federal conservation of world resources; a Declaration of Human Rights which will ensure for every man participation in these resources. But all these, he says, are impossible without the creation of an enlarged and instructed "world mind". This in turn demands the dissemination of education and knowledge on a tremendous scale, and a universal language. Mr. Wells considers Basic English the most promising world language, but all existing languages are unsatisfactory. The words we use don't really mean what we think they mean—language as we know it is a blunt and inefficient instrument. As an example of a misleading and confusing word he somewhat unexpectedly instances the word "science" itself. Ask a dozen people what it means and you will get a dozen widely varying replies.

This formidable programme of adjustment is obviously out of tune with existing realities—an "impracticable dream". "But I tell you", says Mr. Wells, "that if you do not share in this dreaming, if you will not, in the dwindling time that remains to us, do your utmost to realise this dreaming, then, instead of your going out to make a dream come real, fresh nightmares will overtake you and yours and all you care for. ..... Our children and our children's children will pay bitterly, in ignominy, in privation, in straitened unwholesome lives and general brutalisation, as Nature, without haste and without delay, after her manner, wipes them out".

The biological approach adopted by Mr. Wells is unquestionably open to criticism. Experience shows that we must be cautious in applying biological analogies to human affairs. The apostles of cut-throat

capitalism found justification in the works of Darwin. The chief inspiration of the Nazis is a false biological hypothesis—that of the superiority of a non-existent Nordic race. The fact that the Deinosaurs and Deinotheria failed to adapt and were extinguished does not really presage the imminent extinction of *Homo sapiens*. Man is an unusual animal, capable, unlike the Diplodoccus, of envisaging his own extinction. The new environment to which he has to adjust himself is created by his own inventive faculty and not by cosmic forces. *Rapid* advance to super-civilization or degradation to subhuman levels, in accordance with the hopes and fears of Mr. Wells' impatient mind, both seem improbable. But there is no doubt that this view of man as a precariously adapted and momentarily dominant species, not automatically destined for survival and dominance, is important and provocative. Seen against that background, many of our behaviour-patterns, patriotic attitudes and religious and mystical convictions become sheer nonsense.

In this pamphlet, as in many of his other writings, Mr. Wells appeals to scientists to take the lead in creating a "world mind" which will be ready to accept bold schemes of federation, economic adjustment and educational development. He has, perhaps, somewhat exaggerated views about the wisdom and influence of scientific workers. But a study of "Nature" and other scientific periodicals shows that some of the leaders of scientific thought are in fact thrashing out ideas for the creation of a more sensible world. Recently the editor of an English monthly rebuked "Nature" for its growing tendency to discuss such matters; it was becoming, he said, a *political* journal. Scientific workers should stick to their technical work. An obvious reply is that unless we succeed in ordering our affairs more successfully, scientific work may become impossible and its achievements cease to be of practical benefit to humanity.

Mr. Wells is a provocative and often an irritating writer, at once too hopeful and too pessimistic. We can agree with him that our species is passing through a period of danger and that the greatest and perhaps the only hope for ordered progress lies in "adaptation" of the type he describes. We can also agree that scientific workers can play a prominent part in creating an enlarged and more lucid "world mind". At the same time, we must realise that the creation of a better world, after the war has been won, will be a complicated and tremendous task, beset with disappointment. That is all the more reason why it should be faced with boldness and enthusiasm.

W. R. A.

THE GEOLOGICAL, MINING AND METALLURGICAL SOCIETY OF INDIA

THE Eighteenth Annual Meeting of the Society was held on Saturday, 22nd August 1942, in the Mathematics Hall, Central College, Bangalore. Pradhanasiromani Rajamantrapravina N. Madhava Rau, Esq., B.A., B.L., Dewan of Mysore, was the "Chief Guest". After Tea, Mr. S. Lakshmana Rao, Local Secretary (in the absence of Mr. N. N. Chatterjee, the Hon. Secretary of the Society), presented the Annual Report for the Session 1941-42. There was a marked increase in the membership of the Society during the year, there being 3 Honorary Fellows, 193 Ordinary Fellows, and 45 Associates at the close of the Session. Eleven Ordinary General Meetings were held at which a number of papers were read and discussed. With a view to encourage the study of Geology and allied subjects, the Society has decided to award this year three Silver Medals to the best papers on Geology, Mining, and Metallurgy, to be submitted by the Student-Associates of the Society from all over India. The proceedings of the several scientific meetings organised by the Society were, as usual, published in the *Quarterly Journal*, of which five parts were issued in the course of the year.

After the reading of the Report, Mr. B. Rama Rao (Director of Geology in Mysore), President of the Society, delivered his Presidential Address on "Mineral Deposits of Mysore". Mysore, he said, contains deposits of more than forty different types of useful minerals including the metalliferous ores, non-metallic minerals, rare earth minerals, and the gem stones. The principal metalliferous ores found in the State are those of gold, iron, manganese, chromium

and copper; while ores of lead, arsenic, and antimony are also found to a very small extent. Among the non-metallic minerals, there are more than thirty different types and many of them like quartz, felspar, china clay, limestone and graphite are now being largely mined and used in the ceramic, cement and other local industries which have been set up within the last ten or twelve years. On others like asbestos, bauxite, corundum, garnets, etc., investigations are being conducted as to how best to use them locally; and as a result of these, some more industries may be set up in the near future, which would require these minerals as their essential raw materials. Among the rare-earth minerals, small quantities of monazite, columbite, samarskite, and beryl are found in some of the pegmatites in the State, and they have not as yet been used for any purpose. Referring to the future development of the mineral resources of Mysore, Mr. Rama Rao concluded: "Till recently minerals were being mined solely for export, and without any forethought; the richest and the readily accessible portions of the deposits were being extracted leaving behind much of the material as unworkable, useless waste. This suicidal policy of mineral development needs a drastic change. To minimise such avoidable waste of the State's mineral wealth it is very necessary to open the deposits systematically, winning all but the absolutely worthless portions, and to classify the products obtained into several grades by careful sorting and blending, so that the different grades of the material may be supplied to the different industries, all of which may not need the best grades for their purposes. This can only be done by a centralised control, and the Geological Department in Mysore has, consequently, taken up the large-scale mining of some of the minerals which are needed for several of the local industrial concerns, so that it may distribute these minerals in the most economic and best means possible. The Department has also been conducting investigations as to the best means of utilising the portions of the mineral deposits left over, by improving their quality by concentration and by trying to use such grades in local industries. It needs a considerable amount of patient research to make the best use of the available mineral resources and by concerted efforts and continued co-operation of the several industrial concerns in the State, a very large portion of this mineral wealth can be utilised most satisfactorily and to the best advantage of the country."

After the Presidential Address was over, the Chief Guest, Pradhanasiromani Rajamantrapravina N. Madhava Rau, Esq., B.A., B.L., Dewan of Mysore, made a speech in the course of which he said that it was a real pleasure to him to have been able to participate in the function, and complimented Mr. B. Rama Rao, the President of the Society, on his most interesting survey of Mysore's mineral resources. He observed that the Mysore Geological Department was one of the earliest of its kind to be established in India, and that about 25 years ago the Government found it desirable to reorganise the Department with a view to expanding the scope of its activities to include not only geological surveys and theoretical research but practical work involving the exploration of the State's mineral resources for industrial purposes. This reorientation had beneficial results. The policy of allowing private enterprise to exploit the mineral deposits had not been very wholesome. This resulted in deposits of the best quality being removed indiscriminately for purposes of export and the mines being left with deposits of inferior quality which it was not economical to work. He instanced the cases of the manganese and chrome mines in the State. In his view it was best to be conservative regarding the exploitation of minerals.

Concluding the Dewan said that he was glad that the membership of the Society was open not only to geologists but also to persons interested in mining and metallurgy, for it was by the co-operative effort of all these that the mineral resources of the country could be utilised with the greatest advantage.

The President then declared the following members duly elected to the Council of the Society for the year 1942-43:—*President*: Mr. B. Rama Rao; *Vice-Presidents*: Mr. D. C. Nag and Prof. L. Rama Rao; *Joint-Secretaries*: Mr. N. N. Chatterjee and Prof. S. K. Bose; *Treasurer*: Mr. B. N. Maitra; *Librarian*: Mr. Santosh Kumar Ray; *Other Members of the Council*: Mr. K. V. Kelkar, Dr. C. Mahadevan, Mr. Chand Mall, Dr. Raj Nath, Dr. C. S. Pichamuthu, Prof. M. Chatterjee, Dr. A. K. Dey and Dr. Daya Swarup.

CENTENARIES

Ivory, James (1765-1842)

SIR JAMES IVORY, a Scottish mathematician, was born in Dundee in 1765. His father was a watchmaker. After matriculating at the St. Andrews University, he went to Edinburgh to study theology. But his mathematical bias made him come back to Dundee in 1786 as a teacher. In this capacity he introduced the study of algebra in the school course. Three years later he entered flax-spinning business and remained in it till 1804. Even in this interval he kept up his interest in mathematics and contributed four papers to the *Transactions* of the Royal Society at Edinburgh.

In 1804, he became a professor of mathematics in the Royal Military College. To facilitate his teaching work, he prepared a simpler edition of Euclid. His first paper to the Royal Society was read in 1809. It was on the classical theorem bearing his name on the *Attraction of ellipsoids*. His new method of determining a comet's orbit won for him the Copley medal (1814). The approbation of Laplace and the Royal Medals were won by his papers on *Refractions* (1826 and 1839). On the whole Ivory contributed fifteen papers to the *Philosophical transactions*.

Ivory was knighted in 1831 and was elected honorary member of several national societies. In 1829 he offered his scientific library to the Corporation of Dundee; though it was not then accepted for want of a suitable building, it was ultimately taken over in 1866 after the Public Library was established in the Albert Institute.

Ivory died unmarried at Hampstead, 21 September 1842.

Coues, Elliott (1842-1899)

ELLIOT COUES, an American ornithologist, was born in Portsmouth, New Haven, 9 September 1842. He had his education at Washington where his father was employed at the Patent office. Though he held office as assistant surgeon in the army his interest in birds which manifested itself in his boyhood was developed considerably by contact with the Smithsonian Institution. He wrote many elegant papers on the birds of North America and discovered many new species. The bibliography on ornithology which he appended to that fine collection of bird biographies entitled *Birds of the Colorado valley* exhaustively covers 1612 to 1877. He was one of the founders, and later a vice-president and president, of the American Ornitholcgists' Union. He collaborated in the edition of the *Check list of North American birds* (1886) and in the construction of the code of nomenclature by which it was governed. From 1884 to 1891 he contributed to the *Century dictionary* covering many aspects of biology and is said to have been responsible for upwards of 40,000 definitions.

While he was on an arduous journey through New Mexico and Arizona to collect data for a book of his, his health gave way and he died 25 December 1890.

S. R. RANGANATHAN.
University Library,
Madras.

SCIENCE NOTES AND NEWS

Pyrethrum in Mosquito Control.—Russel, Knipe and Ramachandra Rao record (*The Indian Medical Gazette*, 77, No. 8, August 1942) the successful use of water as a diluent for kerosene extracts of Pyrethrum for spray-killing mosquitoes. The "stock extract" was emulsified with water to two dilutions, *viz.*, 1 to 7 and 1 to 3; sodium lauryl sulphate ("Gardinol") was the emulsifier. The spray particles of the emulsion, under comparable conditions, are, naturally, heavier than of the pure kerosene extract, but in spite of this the emulsion spray is almost as effective as the pure extract of the flowers. The costs of the emulsion, as also the *per capita* expenses of field trials, are set out indicating a definite saving when water emulsions are used.

In this connection, it may be recalled that although pyrethrins have been proved to be lethal to mosquitoes and although the quality of any sample of pyrethrum flowers is assayed on its pyrethrin content, it is by no means certain that the insecticidal value of pyrethrum is solely traceable to its pyrethrins; thus Chopra and co-workers find that an aqueous extract of pyrethrum has insecticidal properties (*J. Malaria Inst. of India*, 1940, 3, No. 4) but it is well known that the pyrethrins are insoluble in water; the same workers record that the solid residue *after* the removal of pyrethrin I and II has both insecticidal and larvicidal properties. Further the practice of using pyrethrum residues, stalks, etc., in "joss sticks", "mosquito sticks", etc., is well known. Such sticks are *burnt* to produce the smoke and any pyrethrins present are probably completely destroyed during combustion. At the same time, it is established that smokes from burning pyrethrum and derris (rotenone also is almost completely destroyed by heat) are lethal to certain insects. A survey of the recent literature on these remarkable facts is made by Brightwell in an article on "Fumigation by smokes with special reference to Derris and Pyrethrum" (*Bulletin of the Imperial Institute*, 40, No. 1, March 1942). All this research is calling for a revision of the existing concepts on the active principles of the

well-known vegetative insecticides, their assay, preparation and mode of action.

Identification of Timbers.—With the increase of demand for wood, cheap timbers of poor quality are often put on the market under the name of better class timbers of established reputation. The Forest Research Institute, Dehra Dun, have recently published a pamphlet for the use of non-scientific men ("How to Identify Timbers, Pt. I—Hints on Identification of Indian Timbers", *Indian Forest Leaflet*, No. 21, 1942, price As. 4 or 6*d*.). This pamphlet deals with the characteristic and structural features of timbers in general which are of diagnostic value in a non-technical and lucid style. The text is illustrated with telling illustrations. The keys for the identification of timbers of commercial importance which are to be published in subsequent parts will be received with much interest.

B. G. L. S.

Sugarcane Wax.—Manufacture of sugarcane wax as a byproduct of the sugar industry has again attracted attention of the Governments of South Africa and the United States. R. T. Balch in America (*Industrial Reference Series, Part I, Chemicals and Allied Products* No. 76, October 1941—United States Department of Commerce) and about the same time Narasing Rao and Vidyarthi (*Indian Sugar*, 10, 23) report that the dried press mud-cake contains from 5 to 17 per cent. of wax. Since direct collection would not be economically possible, the American worker has used organic solvents for the extraction of the wax and for the separation of fat from the extracted wax. Toluene has been found to be a convenient solvent for the extraction of the wax from the pressed mud. The removal of the fat is done by cold diffusion using a selective solvent for which acetone is indicated. This method of fat removal has the advantage of the absence of the bad smell, which probably occurs in the putrefactive fermentation method.

On the basis of these results, the Sugar Plant Field Station, Houma, Louisiana, intend to set up a pilot plant.

It is interesting to note the observation of the Indian workers, that the cane-wax corresponds to flax wax and bees wax and contains sterols.

V. S. G.

A Simple Ultracentrifuge with Plastic Rotor.—K. G. Stern, School of Medicine, Yale University, has developed (*Science*, 1942, 95, 561) a simple ultracentrifuge with a rotor of a low density plastic material. This has resulted in a considerable simplification of centrifuge design and obviated the necessity of employing expensive steel and aluminium alloys which are now difficult to procure on account of the war. The first trials were made in Madison with 0·5-inch thick discs of polystyrene and of polyacrylic transparent resins of 1·5 and 2 inches respectively. These discs were transformed into simple air turbines. A two-inch Lucite turbine could be accelerated to 57,000 r.p.m. with the aid of 80 lb. air pressure per square inch as measured by the Kahler-Hunt photoelectric speed measuring circuit. After the mechanical features of the centrifuge had been improved in various respects, the construction of 6-inch plastic turbine was undertaken and the top speed thus far attained with this model, has been 17,400 r.p.m. at 48 lb. per square inch air pressure and an estimated free air flow of 40 to 60 cubic feet per minute, yielding a force of 20,200 times gravity at the centre of the analytical fluid cell which is situated at a distance of 6 cm. from the centre of rotation. This speed is sufficient to cover practically the entire size range of plant and animal viruses as given by Stanley, and in general, to bring about molecular sedimentation, at appreciable rate, of protein particles from about 10^6 molecular weight upwards. As examples of such materials, the sedimentation of earthworm hemoglobin and of Stanley's crystalline tobacco mosaic virus protein, with sedimentation contents of $S_{20} = 60 \times 10^{-13}$ and 175×10^{-13} and molecular weights of 3×10^6 and 40×10^6, respectively, has been photographically recorded, employing the 6-inch Lucite rotor.

The plastic rotors may be adopted to use in centrifuge microscopes as well as in analytical ultracentrifuges. Further developments and applications of this centrifuge will be followed with keen interest.

'Pectin' from Tamarind Seeds.—Pectin is an everyday article of food, and makes its appearance in jams, cold jellies, candies and confectionary. Most of it is prepared from the waste products of fruit juice industries such as apple pomace, lemon and orange pulp, etc. Pectin finds extensive application in other industries also. As a filler in soap it not only increases the yield but adds to its detergent properties. It is used in thickening rubber latex, as an emulsifier in cosmetics, and the metal salts find application as bactericides and as water repellents. The hitherto common sources of pectin are all easily perishable and the pectin industry had to be coupled on to the primary industries of fruit juice expression, etc. A recent examination of various seeds (*Indian Forest Leaflet*, No. 23, 1942, by T. R. Ghosh and S. Krishna) has led to the discovery of a rich source of pectin in the tamarind seeds available in India in considerable quantities as waste product. The seed kernals contain 60 per cent. pectin (alcohol precipitation) and a process for its isolation is detailed.

Photo-Electric Membrane Manometer.—The optical projection method of recording the pressure changes in the cardiovascular systems

of animals by using a membrane manometer, besides requiring a large space is not sensitive enough to record changes of low magnitudes such as auricular pressures in the turtle. The method herein (*Science*, 1942, 95, 513) described overcomes this difficulty by utilising the amplifying properties of electronic device and is found to be superior in every way. The light from a 75-watt exciter lamp of the type used in sound-on-film motion picture projectors is focussed on a small mirror attached on the diaphragm of the manometer and on reflection a small cone of it falls on a photoelectric cell. The arrangement is such that with zero pressure a small part of the light falls on the photo-cell, and as the pressure on the diaphragm is increased, the mirror is deflected and more light enters the photo-cell. The electrical changes brought about thus by the photo-cell are amplified by a push-pull direct coupled amplifier and the output can be utilized for deflection of cathode-ray oscillograph spot or for direct recording. The sensitivity can be easily varied by varying the gain of the amplifier.

The output of this device is linear over a wide range as determined by accurate calibration against a mercury column, connection to which is provided by a three-way valve joining the diaphragm chamber to a side arm or the needle as desired.

The device may be used to record 160 mm. Hg pressure change in the dog ventricle or 1 mm. Hg change in the turtle auricle. The frequency response is good and entirely depends upon the mechanical constants of the vibrating diaphragm. N. B. B.

Kraft Paper from Bamboo.—Kraft paper is now being manufactured in India on a large scale. Indian paper mills have undertaken this manufacture as a result of experiments at the Forest Research Institute, Dehra Dun, which established the suitability of bamboo as raw material for its production.

The average consumption of Kraft paper during the five years preceding the war was approximately 10,000 tons per annum. The use of kraft paper as wrapping and packing material has considerably increased in recent years.

Investigations were started at the Institute in 1937 to explore the possibilities of manufacturing kraft paper from indigenous raw materials. Bamboo, which is available in large quantities at a cheap price, was selected for the experiments and has proved suitable, according to an interim report published by the Institute.

Manufacture of Jute Shoes and Other Extended Uses of Jute.—According to the August issue of the Indian Central Jute Committee *Bulletin*, plaited jute is used for making soles of slippers known as "alpargatas". The manufacture of these slippers originated in Spain and later on it found its way into the Argentine Republic. The Civil War in Spain crippled the industry; and the manufacture of "alpargata" became a regular industry in the Argentine. This kind of footwear is very popular among the poorer classes of the Republic and its consumption is considerable. It is sold at a price which is equivalent to about Rs. 1-3-0 per pair.

In 1937, 254 establishments were exclusively or partially engaged in the industry in which about 7,000 workers and 300 officials were employed. In that year Argentine manufactured about 43,000,000 pairs of "alpargatas".

Two sample "alpargata" shoes have been received by the Indian Central Jute Committee from its Argentine Correspondent. The Director of the Technological Research Laboratories of the Committee is of opinion that similar shoes could presumably be made in India and a cheap article with jute canvas, or cheap cotton uppers might meet with a wide demand.

Burlap and jute supplies are so scarce in the U.S.A. that efforts to secure substitutes are being made in every direction. The jute industry in the country, it is stated, was during the past thirty years, "mortally" afraid of this very situation that had recently developed. The linoleum manufacturers in the U.S.A. are using cotton fabric instead of burlap as a backing. The cotton yarn spinners are reported to have made much progress in developing substitutes for burlap for baling skeins and warps. A Philadelphia firm is stated to have distributed samples of two substitutes made of twisted kraft paper—one of onion bag type of mesh and the other a closer bag weave. Burlap traders of the U.S.A. express great apprehension not only over these developments but with regard to the entire burlap and jute situation.

The *Bulletin* contains an almost exhaustive list of possible new and extended uses for jute.

The Quality of Cotton in Hyderabad.—The Director, Information Bureau, Hyderabad (Dn.), writes in a Press Note:—

"With a view to improving the quality of cotton in the Warangal Suba, H.E.H. the Nizam's Government have sanctioned a five-year scheme submitted by the Agricultural Department. The scheme envisages, *inter alia*, a thorough study of the local varieties, selection of desirable plants from cultivators' fields, production and trial of improved strains against local varieties and investigation into the possibilities of growing remunerative cotton crops in *chalka* soils.

The survey of the cotton crop in the Dominions has shown that the crop grown in the districts of the Warangal Suba is a mixture of several types and much of it is of the various inferior short-staple varieties. The result is that it neither meets the requirements of the Textile Mill in Warangal, nor does it bring an adequate price to the cultivator. The Warangal Mills, which cannot obtain their supplies of the required variety of cotton locally, have to import large quantities of it from other places, incurring considerable expenditure on railway freight. Realising the benefit that will accrue to it from the implementation of the proposed scheme, the management of the mill has offered to co-operate with Government in pushing on the work of cotton improvement in Warangal, by meeting the entire non-recurring expenditure of Rs. 11,000 on setting up a laboratory and half of the recurring expenditure amounting to Rs. 5,562 per annum.

The Cotton Research Laboratory is expected to be put up shortly, while work has already

been started at the Government Farm, Warangal.

Indian Central Cotton Committee.—At the monsoon meeting of the Indian Central Cotton Committee, held from 13th to 18th July 1942, with Mr. P. M. Kharegat, Vice-Chairman of the Imperial Council of Agricultural Research, presiding, the financial position of the Committee, with reference to schemes in progress and other lines of work which it may be necessary to undertake in future, received close attention. Much of the useful work done by the Committee is of permanent value. For instance, the introduction of Jarila cotton, which was largely financed by the Committee, had returned in two years nearly a crore and a half of rupees, i.e., a sum almost equal to the total amount of cotton cess collected by the Committee since its inception. This was no mean achievement, and the Committee is entitled to be proud of it as being a definite indication of the way in which the funds of the Committee had been utilised to the best advantage of the cotton grower.

The present position regarding supply of hoops for baling cotton, fuel and other requirements of cotton ginning and pressing factories was discussed at length and necessary recommendations for immediate attention made to the Government of India.

The following schemes already in operation were extended for periods of about two years in each case:—Surat Seed Distribution Scheme, Scheme for Control of Selection 1 A in Surat Area, Scheme for Cotton Jassid Investigation in the Punjab, and Scheme for Improvement of Punjab-American 289 F/K. 25 cotton. The Scheme for breeding of wilt-resistant cottons in Surat Area was extended for a period of 5½ years. New schemes for studying the economics of clean picking on a large scale in the Bombay Presidency and for a crop-estimating survey on cotton in the Central Provinces and Berar were also sanctioned.

The pilot plant ordered from America for conducting experiments in connection with the production of chemical cotton, will be housed in a separate building in the compound of the New Bombay University Technological Laboratories.

It was agreed that the experiments for the manufacture of cellophane and similar materials should be undertaken at the Committee's Technological Laboratory. The Committee also approved of the recommendations that experiments should be undertaken on the study of the chemical finishes applied to chosen types of yarns and fabrics made from short-staple cotton. It was decided that the results of experiments on pre-cleaning and ginning of Indian cottons should be further continued.

Rao Bahadur Sir Madhaorao Deshpande, Mr. S. T. More and Mr. Madhava Reddi were elected as representatives of cotton-growers of the Committee on the Board of Directors of the East India Cotton Association for the ensuing cotton year.

Central Board of Irrigation.—At the annual meeting of the Research Committee of the Central Board of Irrigation, presided over by Rao Bahadur L. Venkatakrishna Ayyar, I.S.E., Chief Engineer, Madras, and President of the Board, just concluded at Simla, the reports of the five research stations in India, in addition to papers contributed on various subjects, were discussed.

In the Central Irrigation and Hydrodynamic Research Station, Poona, Report, mention is made of the new Approach Channel above the Sukkur Barrage, designed at this Station for the exclusion of sand from the right Bank Canals. This work was completed in early 1941 and the results obtained in the subsequent flood season have been very satisfactory. This Station also designed a siphon spillway for the Jamshedpur water supply reservoir. This Station also investigated the possibility of further supplies from rivers for irrigation purposes. The Nira and Godavari River waters were, however, found unsuitable for irrigation due to high salt content. Investigations were also continued on the reclamation of land damaged by high ground water level, and on the utilisation of town sewage as a manure for irrigated crops. At the Punjab Irrigation Research Institute, Lahore, it has been found that observation pipes in the ground do not show the true ground-water where the water level is high. At Malikpur the river model research station has been enlarged, and a number of successful model experiments have been carried out.

The Sind Research Station has carried out a number of successful model experiments in connection with canal regulators and distributary heads. These are of great importance on a large irrigation system, such as that of the Sukkur Barrage. It is essential to distribute silt in correct proportion between the various channels, and model experiments have been found to be an ideal method of designing distributary heads for this purpose. At the United Provinces Research Station, Lucknow, model experiments have been carried out in connection with percolation losses of water from channels and silting of reservoirs.

The papers presented for discussion at the annual meeting covered the subjects of:—(1) River Behaviour, Training and Control; (2) Sampling of Sand carried in Suspension and along the Bed by Rivers and Canals; (3) The Accuracy of Different Methods of Taking Discharges; (4) Soil Mechanics and (5) Rainfall Runoff. These studies have a considerable bearing on such important topics as fixing the river course, silting of reservoirs, compaction of earth in canal embankments and earthern dams, storage reservoirs, etc.

Regulation of Experiments on Living Animals.—Dr. P. Chalmers Mitchell, President, Universities Federation for Animal Welfare, London, writes in *Nature* (1942, 149, 699), "At the end of June a somewhat rare event will take place. The Home Office will make an appointment under the Cruelty to Animals Act, 1876, which regulates the practice of experiments on living animals.

"An inspector under the Act exercises an important function, not, indeed, as a policeman, but in advising research workers as to the interpretation of their obligations in particular

cases. In view of the number of experiments licensed under the Act, direct supervision is not practicable on any material scale, but I assume that the majority of research workers do not desire to contravene the regulations, and that the inspector's guidance will in general be effective.

"The Act lays down a compromise between the claims of science, on the one hand, and the rights of animals, on the other; the line drawn in the practical application of the compromise must inevitably be an arbitrary one. Until somebody can lay down clear-cut rules which will command general assent, the best that can be done is to make as fair a compromise as possible. This calls for exceptional impartiality, and since a man with the indispensable scientific training will necessarily have a predisposition in favour of science, it is important that he shall also have an offsetting predisposition in favour of the other party in the compromise. This could be ensured by requiring candidates for the post to prove that they have in the past seen effectively associated with some effort to better man's treatment of animals, wild or domestic. Preferably they should also have veterinary knowledge."

Committee on Indigenous Systems of Medicine.—With a view to encourage the indigenous systems of medicine on a large scale and for improving the status of the Vaidyas and Hakims employed by the local bodies, etc., and to examine the allied matters noted below, the Government of Mysore are pleased to appoint a committee consisting of the following gentlemen with Rajasevaprasakta Mr. A. Subramania Iyer and Mr. T. K. Rama Sastry as the Chairman and the Secretary of the Committee, respectively:—Bishagratna Mr. M. Suryanarayana Pandit, Mr. N. S. Krishna Iyengar, Mr. K. C. Subbanna, The Principal of the Government Ayurvedic and Unani College, Mysore, Bishagratna Mr. B. V. Pandit, Mr. Hakim Md. Abdul Salam Aslam, Mr. Hakim Murtuza Khan, Shafikh-ul-mulk Khan Bahadur Mr. Mahomed Abbas Khan, Ayurvedopadhyaya Vaidyavallabha Mr. Singra Iyengar, Rajavaidya Pandit Mr. P. H. Chandrabhan Singh. The points which the Committee are to examine and report are:—

(1) Suggestions for improving the usefulness of the Ayurvedic and Unani College at Mysore.

(2) Formation of a Research Section for investigating the efficacy of herbs and drugs.

(3) Preparation and supply of standard Indian medicines to the various institutions by a central agency.

(4) Undertaking of legislation to regulate the qualifications of Vaidyas and Hakims and to provide for the registration of practitioners of the Indian system of medicine with a view to encourage the study and spread of such systems.

(5) Nature of encouragement to be given to hereditary Vaidyas and Hakims who have not passed the required examinations.

(6) The nature of control to be exercised over the work of Vaidyas and Hakims and the agency therefor.

(7) Grant of leave, pension, provident fund, etc., to Vaidyas and Hakims employed in public institutions or receiving grants-in-aid from Government or local bodies.

The Committee will hold its sittings in the Government Ayurvedic and Unani College, Mysore.

The Principal of the Ayurvedic and Unani College, Mysore, is requested to provide the necessary clerical and other assistance to the Committee.

The Committee is requested to meet early and forward its recommendations to Government before 10th October 1942.

The Deputy Commissioners of Districts, the Presidents of District Boards, the President, City Municipal Council, Mysore, and the Municipal Commissioner, Bangalore City, are requested to furnish promptly any information that may be required by the Committee in regard to the matters referred to it.

The Geological, Mining and Metallurgical Society of India, Calcutta.—The latest number of the *Quarterly Journal* of the above Society (Vol. XIV, No. 1) begins with a paper by Mr. N. N. Chatterjee on "Free Sulphur in Some Weathered Tertiary Coal Specimens of India", in which a brief descriptive account is given of 12 samples of coal which have undergone prolonged oxidation under laboratory atmospheric conditions. This description, together with the probable nature of the chemical reactions enumerated in the paper, will perhaps serve to explain the formation of free sulphur and sulphates in the specimens described. The next paper is a "Note on the Tertiary Sequence in Tripura State, Bengal" by Mr. E. T. Vachell of the Burmah Oil Co., Digboi, in which the correlations between the sub-divisions adopted by Mr. K. L. Das in his recent paper on the Tripura Rocks and the Standard Assam Succession as described by P. Evans are given. Then follow two papers, one by Mr. C. L. Malhotra on "The Working and Dressing of Marble in Makrana Marble Quarries, Jodhpur State", and the other by Mr. G. D. Banerjee on "The Effects of German Silver Addition to the Gray Cast Iron" which were recently awarded the "Student Associate Silver Medals", the former for the best paper on Mining, and the latter, for Metallurgy.

Technological Institute of North Western University, Chicago, was dedicated, according to *Science*, 1942, 95, 2473, in June this year. Built at a cost of $6,735,000 it looks like two letter E's laid back to back and joined by a central structure. There are six wings each of which is occupied by the six departments of physics, chemistry, civil, mechanical, and electrical and chemical engineering. The Institute was established through a gift from W. P. Murphy, inventor and manufacturer of railroad supplies, and was opened in 1939. When fully under way, it will have an enrolment of 900 men, all pursuing a five-year co-operative course which calls for alternating a three-month period of study in the class-room with an equal period of work in the industry. This plan is designed to train the student in practical as well as theoretical engineering and to

assist industry in training its future executives. More than $1,000,000 worth of equipment is already in use for teaching and research and adequate room for expansion has been allowed in all departments.

According to *Science*, 1942, 95, 2473, a National Registry of Rare Chemicals has been established by the Armour Research Foundation. Information on chemicals too rare to be listed in the catalogues of regular chemical supply houses will be filed with the Registry and indexed according to name, location and amount available. Chemicals to be found in the catalogues of supply houses are not included, but all those not available through regular channels will be listed. The file will be regarded as confidential and specific inquiries will be answered by the Registry. In transactions in which the owner of the chemical wishes to remain anonymous to prevent the disclosure of commercial secrets, the Registry will act as intermediary.

MAGNETIC NOTES

Magnetic conditions during August 1942 were more disturbed than in the previous month. There were 10 *quiet* days, 20 days of *slight* disturbance and one of *moderate* disturbance as against 1 quiet day, 21 days of slight disturbance and 9 of moderate disturbance during August 1941.

The quietest day during August 1942 was the 29th while the 16th was the day of largest disturbance.

The individual days were classified as shown below.

Quiet days	Disturbed days	
	Slight	Moderate
1–5, 8, 13, 14, 28, 29.	6, 7 9–12, 15, 17–27, 30–31.	16.

No magnetic storm was recorded during August 1942 while a moderate storm was recorded during the same month of last year.

The monthly mean character figure for August 1942 was 0·71 as against 1·26 for the same period of last year.

M. R. RANGASWAMI.

SEISMOLOGICAL NOTES

During the month of August 1942, 2 slight, 2 moderate and 2 great earthquake shocks were recorded by the Colaba seismographs as against 2 moderate and 6 slight ones recorded during the same month in 1941. Details for August 1942 are given in the following table:—

Date	Intensity of the shock	Time of origin I. S. T.	Epicentral distance from Bombay	Co-ordinates of the epicentre (tentative)	Depth of focus	Remarks
		H. M.	(Miles)			
1	Slight	18 04	8390	..	..	The earthquake shook the whole of the southern part of North Island, New Zealand. Hundreds of chimneys fell, thousands of windows were shattered in Willington.
1	Moderate	20 13	2880	..	..	
7	Great	05 14	6340	..	..	Epicentral region probably located in the neighbourhood of the Aleutian Islands.
20	Moderate	00 00	1540	..	..	
23	Slight	12 05	5130	..	..	According to Fordham University Seismographic station the shock is believed to have originated in the vicinity of the most westerly Aleutian Islands.
25	Great	04 21	10360	Epicentral region located near Lima, Peru, South America	..	One-third of Nazea, an important city in the southern Peruvian area which was rocked by the earthquake, has been completely destroyed. The first shock lasting almost 5 minutes was followed by several others over a period of 2 hours. Severa buildings were destroyed and damaged.

ANNOUNCEMENTS

At a meeting of the Federation of University Women in India, held on August 26, 1942, the President announced the granting of a Federation scholarship of Rs. 180 for medical research to Miss J. R. Manjeri of the Cama Hospital, Bombay, and also the award of a Fellowship of the International Federation of University Women for £250 to Miss Bina Ghosh of Benares University and Oxford. Miss Ghosh has gone to Harvard University for research work in Sanskrit. This is the second Indian graduate to gain an International Fellowship, the first being Miss Kamala Bhagvat of Bombay University.

The Federation of University Women in India is open to any woman graduate of a recognised University irrespective of race, caste and creed.

* * *

We acknowledge with thanks receipt of the following:—

"Journal of the Royal Society of Arts," Vol. 90, Nos. 4613, 4615 and 4616.

"Journal of Agricultural Research," Vol. 64, Nos. 9 and 10.

"Indian Journal of Agricultural Science," Vol. 12, Pt. 3.

"Journal of Chemical Physics," Vol. 10, Nos. 5 and 6.

"Chemical Products," Vol. 5, Nos. 7-8.

"Experiment Station Record," Vol. 86, Nos. 5 and 6.

"Indian Forester," Vol. 68, No. 9.

"Indian Farming," Vol. 3, No. 8.

"Quarterly Journal of the Geological, Mining and Metallurgical Society of India," Vol. 14, No. 2.

"The Indian Central Jute Committee Bulletin," Vol. 5, No. 5.

"Indian Information Series," Vol. 11, No. 100.

"Review of Applied Mycology," Vol. 21, Nos. 4 and 5.

"The Bulletin of the American Meteorological Society," Vol. 23, No. 3.

"Indian Medical Gazette," Vol. 77, No. 8.

"Nature," Vol. 149, Nos. 3785, 3786, 3788, 3790 and 3791.

"Journal of the Bombay Natural History Society," Vol. 43, No. 2.

"Journal of Nutrition," Vol. 23, Nos. 5 and 6.

"American Museum of Natural History," Vol. 50, No. 1.

"Indian Journal of Physics," Vol. 16, Pt. 2.

"Canadian Journal of Research," Vol. 20, No. 4-5.

"Science," Vol. 95, Nos. 2471, 2472, 2474-76.

"Science & Culture," Vol. 8, No. 3.

"Indian Trade Journal," Vol. 145, Nos. 1877-79; Vol. 146, Nos. 1880-89.

Books

Short Wave Wireless Communication Including Ultra-short Waves. By A. W. Ladner and C. R. Stoner. (Chapman & Hall, London), 1942. Pp. xiv + 573. Price 35*sh.*

On Growth and Form. By Sir D'Arcy Wentworth Thompson. (Cambridge University Press, London), 1942. Pp. 1116. Price 50sh.

Annual Review of Physiology, Vol. IV. Editors: James Murray Luck and Victor E. Hall. (American Physiological Society and Annual Reviews, Inc., California), 1942. Pp. 709. Price $5·00.

Mathematics, Its Magic and Mastery. By Aaron Bakst. (Chapman & Hall, London), 1941. Pp. xiv + 790. Price 21*sh.*

Practical Physics for Intermediate Students. By V. Venkata Rao, D. A. A. S. Narayana Rao and T. S. Narasimhamurty. (Department of Physics, Maharajah's College, Vizianagram), 1942. Pp. 218. Price Rs. 2-4-0.

A Text-book of Intermediate Physics, Vol. II (in Tamil). By R. K. Visvanathan and V. N. Ramaswamy. (Annamalai University, Annamalainagar), 1941. Pp. 689-1372.

ERRATA

Vol. 11, No. 8, August 1942, page 334, Table I (*b*), under Moisture and Protein, the figures for Sode II and Golim should be as follows:—

	74·80	19·41
	75·30	19·60
and not	19·41	2·08
	19·6	2·86.

Vol. 11, No. 8, August 1942, page 330, Note entitled "Arc Lines of Copper in Flame Spectra"—

Add the following before the present opening sentence:—

In the course of an investigation which is in progress and a preliminary report about which has already been published on the study of the flame spectra of copper salts, we have found a few interesting points regarding the excitation of certain atomic lines of copper which it is our purpose to report in this note.

In line 9, *for* $3d^94s$ (3D) *read* $3d^9\ 4s\ (^3D)$.

Add the following after the last sentence:—

Full details regarding these and other features of the flame spectra will be published elsewhere; I also feel it a pleasure to thank Prof. Dr. R. K. Asundi for valuable discussion.

978-42—Printed at The Bangalore Press, Bangalore City, by G. Srinivasa Rao, Superintendent, and Published by B. N. Sastri, M.Sc., A.I.C., A.I.I.Sc., for the Board of Editors, "Current Science", Bangalore.